ECONOMIC GEOGRAPHY

VOL. 8 JULY, 1932 NO. 3

THE PORTS OF FINLAND

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AMONG the new Baltic states, formed by the World War, Finland (Suomi) easily occupies the first place with regard both to extent and number of inhabitants.

THE COUNTRY AND ITS PEOPLE

Its area measures 388,500 square kilometres, or 150,000 square miles, while Latvia occupies 65,800 square kilometres and Esthonia only 47,550 square kilometres. Its preëminence in number of inhabitants is equally marked, the exact number calculated for Finland at the close of 1924 being 3,495,186 (1926 round 3.6 millions), while Latvia in the beginning of 1925 had 1,844,805 and Esthonia at the close of 1926, 1,116,325 inhabitants.

The geological and climatic conditions of Finland differ in several respects from those prevailing in the other Baltic states. Geologically, Finland is a part of the great Fenno-Scandian shield, while Esthonia and Latvia are in direct connection with the Russian plateau and form its border against the sea. The geology of Finland is thus characterized by old crystalline rocks, such as granite and gneiss, to a great extent covered with glacial drift. Most of the surface is very uneven, though there are no really high mountains. Everywhere hills protrude from the sands and clays formed by the ice. Long ridges of sand, sometimes containing large boulders, are a prominent feature in the Finnish landscape. They generally stretch from northwest to southeast, the direction in which the ice was moving, and are lateral moraines, but the largest of these formations, the Great and Little Salpausselkä, are terminal moraines and stretch from southwest to northeast.

The most prominent feature of the country is the great multitude of lakes that cover its surface. Nowhere in the world, not even in Canada, is there anything like it. The number of lakes is estimated to be a hundred thousand, forming an area of water surface of 44,300 square kilometres, or nearly 12 per cent of the total surface of the country. There are lakes of every type and size. Most are shallow, have irregular contours and are studded with islands. But there is also found a number of deep troughs, resembling the Scottish lochs on a smaller scale.

In the south of Finland the lakes form three distinct groups, each with its own central basin and draining river. Farthest east is the large Saima-system comprising several thousand lakes, together occupying a catchment basin of 60,100 square kilometres. They are drained by the river Vuoksi, which empties into Ladoga, the largest lake in Europe. In the middle of the country lies the

Päijänne-system, whose basin occupies about 37,000 square kilometres and is drained by the river Kymi, which falls into the Gulf of Finland. The lakes of the west mostly belong to the Pyhäjärvi group, which comprises about 27,000 square kilometres and whose water is carried to the Gulf of Bothnia by the large Kumo River.

Besides these large and complicated lake systems there are a number of smaller groups and individual lakes drained by short coastal rivers. In the south the largest of these is the lake of Lojo, which has of late become the center of an important industrial activity. Farther north lies the Kajana Lake, which is in connection with two long chains of waters, thus forming a fourth large system. It is drained by the powerful Uleå River (Oulu-joki) which has many cataracts and falls into the Gulf of Bothnia. In the extreme north there is the Inari Lake, whose water is carried to the Arctic Sea by the Pasvik River.

The lakes form excellent inland waterways, which are continually being improved by the construction of canals. At present there are about twenty such constructions in the interior of the country besides two on the coast. The most important of these canals is the Saima Canal, which unites the Saima Lake with the Gulf of Finland at Viborg. The difference in height between the lake and the sea (80 metres) necessitates no less than 28 locks, which are at present being enlarged to give access to vessels of 600 tons capacity. The number of steamers and barges that yearly pass through the canal now reaches 10,000.

FIGURE 1.—The south harbor of Helsinki (Helsingfors) exhibits the salient characteristics of the waterfront of most of the Finnish ports. Bottoms from most of the maritime lands of the world, as well as local craft, are tied up along the wharves. (Courtesy of the Finnish Legation, Washington, D. C.)

The rivers of Finland are comparatively short but swift flowing and carry much water at all seasons. Navigation is obstructed by falls and cataracts that break their courses. In all there are 1,462 falls with a minimum height of 50 centimeters and a capacity of 50 horsepower. The total water power of Finland is estimated to be about 2½ millions of horse power, of which only one-fourth is actually in use. The largest hydraulic power

stations in Finland are situated at the Vuoksi and Kymi Rivers, but there is a large number of smaller plants spread all over the country. The most important establishment of this kind is the Imatra central station, which is being built by the Finnish state. It is situated at the famous cataract of the same name and is designed ultimately to develop 150,000 horsepower, which will be distributed all over the south of Finland as far as Åbo in the west.

Though generally hilly, Finland is not wholly destitute of level parts. The largest plains extend along the Gulf of Bothnia, forming the important agricultural district of Ostrobothnia. Its fertile clays have been deposited in the sea, which until recently covered not only this region, but the greatest part of Finland. The sea is still receding, thus by degrees extending the arable land. Outside Ostrobothnia the largest fields in Finland are found in the southwest around the city of Åbo. This region has been inhabited and cultivated since time immemorial, and is even now, agriculturally, the most productive part of the country. Other plains of importance stretch along the Gulf of Finland through the fertile and thickly inhabited district of Nyland. Even in the interior of the country stretches of level land, suitable for farming and grazing, are found in many places, especially in the vicinity of the large lakes.

Fringing the coasts of Finland is a belt of islands, islets and rocks, forming an extensive and picturesque archipelago (Swedish "skärgård"). It is really a part of the uneven and hilly surface of the country, where the valleys are still submerged while the higher parts protrude as islands above the surface of the sea. In places it is narrow or totally absent. At other points, especially in the southwest, it is 60 miles broad and comprises a number of large and fertile islands, thickly inhabited.

The climate of Finland is much more favorable than might be expected from its situation so far to the north. The mean temperature is about +5° (Centigrade) or about 6° higher than the normal temperature of the same latitude. This depends partly on the proximity of the Atlantic, partly on the fact that Finland is bounded on two sides by large areas of waters, the Gulf of Bothnia and the Gulf of Finland, which act as reservoirs of heat. The warmest month is July, when the mean temperature in the southern part of the country is 17° and some years rises to 22° C., while it is only 6° in Lapland. The coldest month is February, when the mean of the readings is only −4°, while temperatures as low as −30° are registered even in the southern part of the country.

The prevailing winds are southwesterly, carrying the moist and warm air from the Atlantic to the country. Northerly winds are cold, while the easterly winds raise the temperature and bring rain in summer and snow in winter. The yearly rainfall averages 530 millimetres (21 inches), of which a considerable portion falls in the form of snow. In the south of Finland snow begins to fall in October and melts away in April. The lakes and the coastwaters of the sea are regularly frozen over in winter. The ports of the south of Finland are generally closed by ice from the middle of January to the middle of April, while the northern ports may be icebound till the middle of June. Navigation is, how-

ever, kept going in a number of ports by means of powerful ice-breakers.

In consequence of the favorable climate the vegetation of Finland is more abundant and varied than might be expected from the geographical situation of the country. There are about 700 different species, the flora naturally being richest in the southern part. Many kinds of trees are represented, but firs and pines form the real forests of Finland. They are of vast extent, covering over 19 million ha (49.4 million acres), or about half of the surface of the country. The greater part of the forests belong to the state, which owns about 12½ million ha (30.7 million acres). The forests represent the greatest wealth of Finland and furnish the material for all its most important industries, including the manufacture of cellulose, pulp, and paper.

The population of Finland now numbers about 3.6 millions, or a little less than 10 to the square kilometre. The most densely populated part of the country is Nyland where the number rises to 37 per square kilometre. The coastal regions are as a rule more populous than the interior parts, and most of its larger towns are situated on the coast. But there are some thickly peopled districts about the large lakes of the interior.

The greater part of the inhabitants of Finland, or 80 per cent, live in the country, while the city population

FIGURE 2.—The Fenno-Scandian terraine of Europe is thick set with lakes as is the Laurentian upland of North America. The landscape of Suomi is much like the spruce-mantled, glacier-worn, crystalline hills of Quebec. A view over Päijänne Lake in Central Finland. (Courtesy of the Finnish Legation.)

comprises only 20 per cent. There is only one large city: Helsingsfors (Helsinki), the capital, which in 1926 had 215,800 inhabitants. Among the other towns the most important are Åbo (Turku), the old capital; Viborg (Viipuri), the important commercial city of the east; and Tammerfors (Tampere), the great industrial center of the interior. Their populations were in 1926 61,500, 52,400, and 49,000, respectively. Besides these there are at present 34 other towns, most of which are small.

INDUSTRY AND TRADE

The most important industries of Finland are those based on the natural resources and products of the country. Foremost among these is the wood-working industry, which comprises many different branches, such as the manufacture of planks, boards and deals, pulp and paper, cardboard and cellulose, pit-props and firewood. Finland is now the greatest exporter of sawn timber in the world, the export amounting to 1,000,000 standards and even more during the last three years. There are sawmills all over the country, but the largest are situated in the Saima district and at the mouths of the Kymi, Kumo, and Kemi Rivers. The logs mostly come from distant places and are floated through lakes, rivers, and especially constructed channels to the mills. The number of logs thus brought down reaches 20 millions a year, and the sawn timber is exported to all parts of the world.

The following figures illustrate the activity within the sawmill industry.

Year	*Sawmills*	*Number of Workers*	*Value of Production Mill. Mks.*
1923	489	38,856	1999.8
1924	455	37,443	1945.2
1925	465	38,115	2070.0
1926	513	40,267	2295.1

The other great branch of the wood-refining industry, comprising the manufacture of paper and allied articles, is younger but has grown faster as seen from the following table:

Year	*Paper Mills*	*Number of Workers*	*Production in Tons*
1913	25	4,617	167,631
1923	29	4,810	209,395
1925	29	4,592	258,718
1926	28	4,693	256,931

The cellulose industry has, however, developed quicker than any other branch of the Finnish paper industries. The number of workers employed here has increased since 1913 by 98 per cent, the production of sulphate cellulose by 70 per cent and that of sulphite cellulose by 315 per cent. The development is perhaps best seen from the following table:

Year	*Cellulose Factories*	*Number of Workers*	*Production in Tons*	
			Sulphate	*Sulphite*
1913	17	2,758	64,697	79,895
1923	25	6,019	79,582	238,139
1925	25	5,293	96,764	299,386
1926	25	5,456	109,637	331,654

The growth within the pulp and cardboard industries has been less pronounced. The production of cardboard has not yet reached its level of 1913, whereas that of pulp has increased by 47 per cent. There is, however, another branch of the timber industry that merits special attention. This is the plywood manufacture, which has rapidly developed into an important industrial activity. In 1913 there were only 3 factories, employing 229 workers, but in 1926 there were 15 factories with 3,815 workers. The gross value of production in the latter year was 180 million marks and the amount exported rose to 50,500 tons.

Among other industries based on materials found in the country, the cement works should be specially

mentioned. Before the war this necessary and important article was wholly obtained from abroad, mostly from Sweden, Denmark, and Belgium. Now there are two large and modern factories producing cement, which practically supply the country's need

FIGURE 3.—An avenue through the splendid primeval forest of conifers upon which the whole industrial economy of Suomi is based. (Courtesy of the Finnish Legation.)

of this ware and even produce for export. There are excellent beds of clay and limestone but the coal must, of course, be imported.

Finland is on the whole deficient in valuable minerals, though small quantities of gold, graphite, zinc, and copper are found in places. There is no mining comparable to that of Sweden or Norway. The most important metallurgical concern is the Outohumpu copper mine in the province of Savolaks (Savo), which is managed by the State. Besides copper it produces zinc and lead in appreciable quantities. No high-grade iron ore has as yet been found in Finland, but it is assumed that beds of this mineral are hidden under the marshes of eastern Carelia.

Before and during the war the metal industries came next to the timber industries in national importance. A considerable quantity of machinery and ships, both for the commercial fleet and the navy, was exported to Russia, but since Finland was separated from that country the Russian market was lost. There has, however, been some recovery later, and during 1926 the number of workers increased by 7 per cent and the value of production by 7.5 per cent.

The break with Russia naturally had a detrimental effect on several other branches of industry, notably the textile factories, which formerly to a great extent were working for the Russian market. A gradual recovery is visible also in this field.

Among other kinds of industrial activity mention should perhaps be made of the boot and shoe industry which has undergone a remarkable development. In 1913 there were only 16 factories with 1,100 laborers, while in 1926 the number of factories had risen to 52 and that of workmen to 3,702. The other branches of the leather industry do not show a similar growth.

Finland is, on the whole, an agricultural country, and no less than 66 per cent of its population is engaged in farming. Owing to the small area of good arable land and the severe climate Finnish agriculture

does not as yet produce sufficient breadstuff for the people, and considerable, though diminishing, quantities of grain have to be imported, mostly from America, Russia, and Poland. Cattle rearing and dairy farming are, however, very successful and large quantities of butter are produced for export. There has been an almost continual rise in the quality and quantity of the Finnish butter, which is steadily gaining ground on the English market. In point of value the butter produced comes next to the standard products of the wood-working industry, while in national importance it stands, perhaps, first.

The following table will give some idea of the present status of Finnish industry and the relative position of its different branches:

FIGURE 4.—Winter transport of the felled logs by horse-drawn sledge to the ice-bound lakes and waterways. (Courtesy of the Finnish Legation.)

	Number of Workers		*Gross Value of Production Million Marks*	
	1925	*1926*	*1925*	*1926*
Timber industry	47,877	52,135	2,546	2,824
Paper industry	15,884	16,039	1,899	2,088
Foodstuffs industry	10,188	9,880	1,941	1,957
Metal industries	22,545	24,102	1,129	1,216
Stone, clay and glass industries	9,288	9,660	337	407
Leather and tanning industries	5,262	5,686	465	465
Tar, oil and rubber industries	1,338	1,394	201	229
Chemical industry	2,049	2,189	136	144
Graphical industries	4,673	4,940	189	210
Lighting and power transmission	2,879	2,838	293	335

The foreign trade of Finland is steadily growing and already well developed. At first it was confined to the countries situated around the Baltic Sea, but later it was by degrees extended to comprise not only most parts of Europe but also North and South America, South Africa, and even the Far East. This growth is largely due to the improvement of communications, which has taken place, especially through the establishment of the Finnish Steamship Company of Helsingfors. This large concern now maintains thirteen different lines to all the principal ports of northern and western Europe, except Hamburg and Bremen, which are served by German ships. Lately the activity has been extended to the Mediterranean. Finnish trade with North America is carried on by the American Scantic Line, lately of United States Shipping Board, and the Swedish American Line. There is a Finnish line of steamers to the ports of South America, but a considerable part of the growing trade between Finland and Latin America is conveyed in German and Swedish ships.

The growth of the foreign trade of Finland is clearly seen from the figures computed yearly by the Board of Customs. They show, for instance, that the total volume of trade in 1927 was about 15 per cent greater than it was in 1926, 22 per cent greater than in 1925, and 32 per

FIGURE 5.—Summer transport of logs by water from the forests where they are felled to the mills where they are sawn into timber. Punkaharju, one of the beauty spots of Suomi. (Courtesy of the Finnish Legation.)

cent greater than in 1924. The value of the export and import per unit of population now amounts to about 4,000 marks or $100, a figure which compares favorably with corresponding numbers of most other countries.

Among the articles of export from Finland the products of the timber and sawmill industry easily rank first, comprising no less than about 60 per cent of the total value of the country's exports. The second place is occupied by the manufactures of the paper and pulp factories, representing about 26 per cent of the total. Agricultural products, mostly meat, butter, and cheese, count for 12 per cent, while the remainder is made up of various articles, such as agricultural machinery, granite, matches, furs, and whortleberries.

The import is much more varied than the export and includes two different groups of goods. The one comprises articles for productive purposes, such as raw materials, machinery, and means of transport. The other contains goods for direct consumption, principally foodstuffs, luxuries, and other finished industrial articles. The latter group was in 1927 calculated to comprise no less than 47 per cent of the total import, but it is now diminishing. This shows that the agriculture and the industry of Finland are progressing, though they are not yet fully able to satisfy the country's need of foodstuffs and manufactured articles.

The growth of the export and the import as well as the nature and variation of the difference between them is seen from the following table, which gives the values in millions of Finnish marks (40 marks = 1 dollar).

Year	*Export*	*Import*	*Difference*
1922	4,468	3,970	+498
1923	4,393	4,600	−207
1924	4,971	4,715	+256
1925	5,573	5,519	+54
1926	5,637	5,668	−31
1927	6,323	6,367	−44

The balance of trade thus in 1926 and 1927 nominally resulted in deficits of 31 and 44 million marks respectively. If it is, however, borne in mind that the value of imports is calculated c.i.f., and the value of export f.o.b., it will be seen that even in those years the foreign trade of Finland provided a positive quantity in favor of the country.

It might be of interest to see how the foreign trade of Finland is divided amongst the countries that take part in it. This side of the commerce is sufficiently illustrated by the following three tables, the first of which gives the value of each country's part, expressed in per cent of the total amount of trade. The second and third tables similarly give each country's place with regard to the export and the import, considered separately.

As seen from the tables, the first place among the countries which have trade relations with Finland is occupied by Great Britain, while

TOTAL FOREIGN TRADE OF FINLAND

Country	1923 %	1924 %	1925 %	1926 %	1927 %
Great Britain	29.6	29.8	27.0	25.6	27.2
Germany	20.4	19.5	22.6	23.8	24.2
U. S. A.	10.3	9.6	10.0	10.3	10.4
Holland	6.9	7.1	7.4	8.0	6.7
Sweden	5.8	5.6	5.4	5.6	5.7
Belgium	5.2	4.7	4.6	4.2	4.7
Russia	3.3	4.6	4.6	2.9	4.2
France	5.5	5.3	4.0	5.4	3.9
Denmark	5.1	5.3	4.7	4.0	3.7
Norway	0.6	0.6	0.6	0.7	0.6
Other European countries	3.1	3.2	3.7	4.5	4.1
Other countries outside Europe	4.2	4.7	5.4	5.0	4.6
Denmark	5.0	3.9	3.2	2.5	2.2
Norway	0.6	0.5	0.4	0.5	0.4
Other European countries	1.1	1.3	2.1	2.6	2.6
Other countries outside Europe	5.2	5.6	5.9	6.2	5.6

Germany comes next. It is as a buyer of Finnish goods that Great Britain stands preëminent, while as a supplier it is of less importance. Germany in this respect takes first place. The total trade of the latter

FIGURE 6.—An up-to-date saw mill of Suomi, an expression of the progress the land has made in the utilization of its resources, since its independence from Russia, and the establishment of its stable socialized republic. (Courtesy of the Finnish Legation.)

IMPORTS TO FINLAND

Selling Countries	1923 %	1924 %	1925 %	1926 %	1927 %
Germany	34.0	29.9	31.9	34.9	32.6
U. S. A.	12.7	13.3	14.7	14.1	15.4
Great Britain	18.4	18.8	17.0	12.8	14.2
Sweden	5.7	6.2	6.5	7.4	8.2
Denmark	5.2	6.8	6.3	5.5	5.4
Holland	5.4	4.8	5.6	5.8	4.4
Belgium	3.2	2.9	2.7	3.1	3.3
Russia	4.7	4.7	1.4	1.9	3.3
France	1.9	2.4	3.0	3.5	3.1
Norway	0.6	0.8	0.9	1.0	1.0
Other European countries	4.9	5.6	5.2	6.2	5.9
Other countries outside Europe	3.3	3.8	4.8	3.8	3.5

EXPORTS FROM FINLAND

Buying Countries	1923 %	1924 %	1925 %	1926 %	1927 %
Great Britain	41.3	40.3	37.0	38.4	40.2
Germany	6.2	9.1	13.4	12.7	15.8
Holland	8.5	9.3	9.2	10.3	9.0
Belgium	7.3	6.4	6.5	5.3	6.0
U. S. A.	7.8	6.1	5.3	6.5	5.4
Russia	1.9	4.4	7.7	3.9	5.0
France	9.3	8.1	5.0	7.2	4.7
Sweden	5.8	5.0	4.3	3.9	3.1

country moreover steadily grows, while that of England shows a tendency to fall off. According to the newest statistics, calculated from the figures of 1928, Germany has actually passed England and now occupies first place. It must be observed too that Germany plays a much larger part as a middle-man in Finnish trade than does England. Many of the articles produced in the southern countries of Europe and other parts of the world are imported to Finland by way of Hamburg and Bremen, and much of the Finnish goods of export for distant lands goes through the same ports.

The United States also takes

a prominent part in the trade with Finland, occupying third place among the countries. In respect to the export to Finland they have passed England and now come next after Germany. The articles imported from America mainly consist of cereals, especially wheaten flour, cotton, oils, and machinery, including automobiles, while the export is made up of cellulose, paper, and newsprint.

Among the other countries which merit special attention in this respect, Holland, Belgium, and France may be mentioned as large buyers of Finnish timber and paper goods, while their export to Finland is not very important. Sweden on the contrary exports to Finland much more than it imports from there, and the balance of trade between the countries is continually becoming more unfavorable to Finland. Russia, which before the war was Finland's best customer, now practically only takes limited quantities of paper. The trade with Italy and Spain is growing and the same may be said with respect to the great markets outside of Europe, especially Brazil, which is progressing fast.

THE PORTS AND THEIR CLASSIFICATION

The coasts of Finland are very indented and protected by a multitude of islands, islets, and rocks. There are many deep inlets and sounds, which have no tide water and where ships can anchor and load in safety. Only a fraction of these potential harbors are actually used for traffic. On many stretches of the coast there is a principal port and a number of accessory harbors used only for special purposes. Thus in the Åbo custom-house district there is the large port of Åbo and nine auxiliary harbors, one for the discharge of coal and eight for the loading of sawn timber. The latter are frequented only by a few ships in the year.

The whole coast is divided into twenty-four custom-house districts, each with its own central port. According to the State Committee on Ports, whose report was published in 1925, there are in all seventy-one harbors. But the list is not complete. It does not include either the fishing ports or the inland ports, which form a large and important group. All told the number of places used in the commerce and navigation of Finland is well over a hundred.

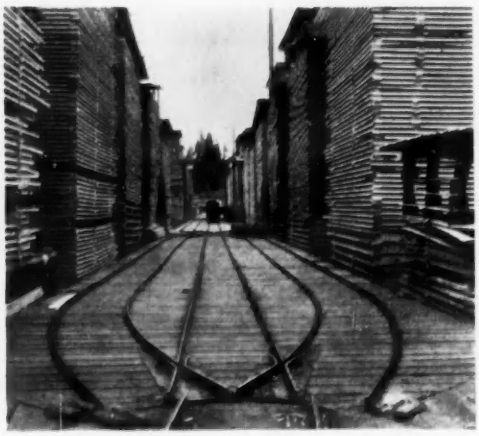

FIGURE 7.—Stores of superior Suomi lumber, nearly all excellent softwood, awaiting shipment to timber-deficient lands of Central and Western Europe. (Courtesy of the Finnish Legation.)

From a geographical point of view the ports on the coast may be divided into two main groups. The one contains places situated at the mouths of great rivers and possessing direct connection by water with the interior of the country. They are chiefly ports of export, the principal articles shipped being sawn timber, cellulose, and paper. The most important places belonging to this group

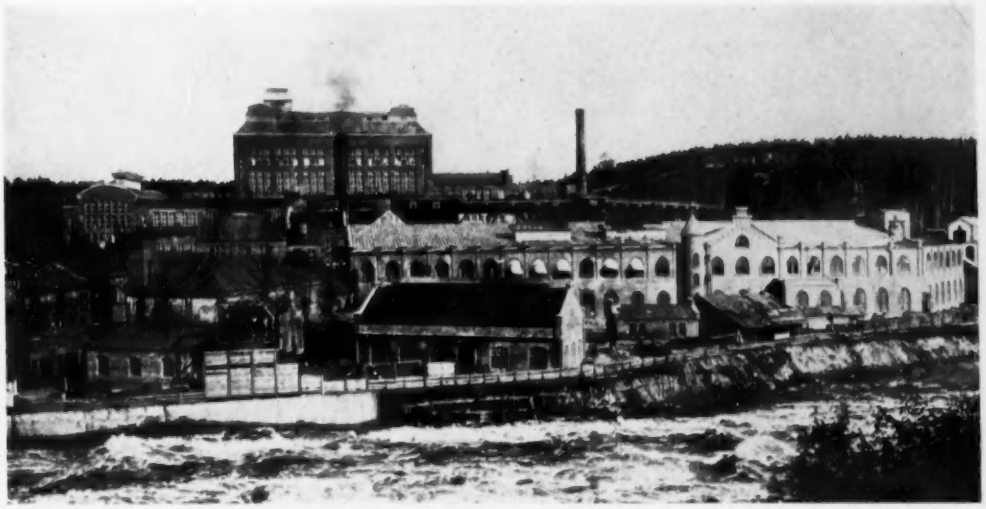

FIGURE 8.—Such modern, superbly-equipped plants as this pulp and cardboard factory at Enso demonstrate the efficiency of Finnish industrial organization and the high state of national culture. (Courtesy of the Finnish Legation.)

are Kotka, situated at the mouth of the Kymi River, Björneborg at the Kumo River, Oulu (Uleåborg) at the Oulu River and Kemi at the Kemi River. In this group may be included Viborg with its great harbor Trångsund, which has direct communication with the interior through the Saima Canal. It must be observed at once that all the towns mentioned, and especially Viborg, have a considerable import. Besides the above-named large timber ports there are a number of smaller places whose foreign trade mainly consists of the export of wood. The most important of these are Fredrikshamn, Lovisa, and Borgå on the south coast, Raumo, Kristinestad, Gamla Karleby and Torneå on the west coast.

The other great group comprises ports which do not have water communication with the interior and whose connection with more distant parts of the country is maintained exclusively by railways. They are comparatively large towns which are situated at the centers of populous and fertile districts, have a well-developed industry, and thus represent markets of considerable capacity besides acting as centers of distribution. The principal ports belonging to this group are Helsingfors, Åbo, Vasa, and Jakobstad. In this class may also be included Hangö, which, however, occupies a peculiar position as will be seen later. It should be added that all the ports lately mentioned, but especially Helsingfors, also serve the export trade.

Owing to the northerly position of Finland a belt of ice is regularly formed along the whole coast of the country in winter. Navigation is thus interrupted for two to six months in the year, depending on the position of the port. In the northern part of the Gulf of Bothnia ice begins to form in the middle of November, and the ports remain closed till the beginning of June. On the south coast the period of ice blockade is much shorter and sometimes even vanishes. This refers especially to Hangö and Åbo, the positions of which,

back of the islands, protect them from the heavy ice-fields often formed in the open sea. These ports, which may be designated as the real winter ports of Finland, are nowadays kept open by ice-breakers all the year round. Lately endeavors have been made to extend the winter traffic to other ports than the two just mentioned, more especially Helsingfors and Björneborg. They have been, at least in a great measure, successful and it is probable that by the use of still larger and more powerful ice-breakers, other ports may be kept open in the future.

One can see that Finland is the land of lakes, and that by the construction of a few canals watercourses navigable for hundreds of miles have been opened in the interior of the country. Inland navigation now plays a very important part in the economic life of the nation. A large and growing traffic, mostly comprising heavy goods, such as timber, grain, and fertilizers, but also general merchandise and passengers are carried by barges, motor vessels, and passenger steamers plying on the lakes. At the junction of different watercourses and other favorable points towns have grown up and become the centres of lively and extensive trade. Thus before the war, the town of Kuopio, situated on Lake Kallavesi several hundred kilometres from the coast, was in direct communication with St. Petersburg and even with Lübeck in Germany through the Saima Canal. The connections were then broken and have not yet been resumed, but there is no doubt that the inland navigation of Finland is capable of great development and will grow in the future.

The ports on the Finnish coast of Lake Ladoga occupy a peculiar position intermediate between maritime and lake ports. Besides serving the local traffic they handle a considerable part of the trade with Russia, which before the war was of great importance to Finland. The products of Carelia, such as timber, firewood, and victuals, were carried from these ports by lake vessels to St. Petersburg, the great market of eastern Finland. Since the separation of Finland from Russia took place, and the new economic system was introduced in this country, this traffic has declined as has the whole of Finnish trade with Russia.

PRINCIPAL PORTS

Having gained some idea of the industry and trade of Finland and of the natural conditions which determine the function and development of the ports and harbors of the country, the author proposes to give a short description of a few of the most important among them, confining his attention to the six ports of Helsinki (Helsingfors), Turku (Åbo), Vaasa (Vasa), Viipuri (Viborg), Kotka, and Pori (Björneborg), a group which handle more than four-fifths of the total sea-borne trade of Finland and includes representatives of every class of port found on the Finnish coast.

Helsinki (Helsingfors)

It is natural to commence with Helsingfors, which occupies a unique position among the maritime towns of Finland. It is not only the largest and best equipped port in the country, but also has the greatest traffic measured both by the tonnage of ships cleared and the value of goods handled. As regards imports, it far surpasses its rivals. Helsingfors is not only the largest city and

the most important industrial place in Finland, but also serves as a great center of trade, from which a large part of the country is provided with goods. It is a well-known fact that coöperation in trade has been carried further in Finland than in any other country, except perhaps Russia. The greatest part of the inland trade is now managed by a few large organizations, which have their offices and stores in the capital and use its port for their extensive imports of foreign goods. Helsingfors thus makes the greatest market of Finland, and its position in this respect is strengthened in proportion as its communications are being improved. As regards railroad connections, it is already far ahead of its competitors, being the capital in a country where practically all the railroads are owned and managed by the state. And considering communication by sea, it must be remembered that Helsingfors is the seat of the Finnish Steamship Company, whose management naturally aims at a gradual centralization of traffic in the capital. It is, moreover, the Finnish station of the Swedish, German, and American liners, trading in the Baltic, and it is the only port in Finland regularly visited by the numerous pleasure steamers which cruise in the northern waters during the summer.

Some statistics illustrating the remarkable growth of traffic in Helsingfors and showing the position of the capital among the ports of Finland will be given later. But its importance is clearly indicated by the fact that the amount of the receipts collected at the custom-house of Helsingfors equals those of all the other ports of Finland put together.

Helsingfors has a very favorable position on a headland, which stretches into the Gulf of Finland in the middle of the south coast. It is surrounded on all sides by larger and smaller islands, which protect it from the sea and divide the water area adjoining the city into a number of harbors or basins, each of which serves a different purpose. On the east side of the city are the South Harbor and the North Harbor, separated by a headland about a mile long. The South Harbor has a depth which varies between 9 and 32 feet (2.7–9.7 metres) at the quays, and the length of the quays is at present about 1,500 metres. It is used by steamers plying on the coast and by passenger and cargo liners keeping Helsingfors in regular communication with all the principal ports on the English Channel, the North Sea, and the Baltic. The North Harbor is reserved for local traffic, being used by small coasting vessels and steam launches plying between the city and the adjoining islands. Part of the North Harbor is occupied by the Finnish fleet, the head station and offices of which are located in the vicinity.

Outside the South and North Harbors extends the wide and deep roadstead called the Kronbergsfjärden, where large warships and liners anchor. It is protected from the sea by a group of islands, partly occupied by the forts and barracks of Suomenlinna (Sveaborg). The main entrance to Helsingfors from the sea leads between these islands to the Kronbergsfjärden, where it divides. Though rather narrow in places, it is of sufficient depth (30 feet or 9 metres) to admit ships of almost any size.

At the head of the Kronbergsfjärden, adjoining the North Harbor, is the Sörnäs Harbor, which is used principally for the loading of sawn

timber. The export of wood and paper from the interior of Finland by way of Helsingfors, though inferior to that from Viborg or Kotka, is considerable and growing. To facilitate this traffic the Sörnäs Harbor has been provided with a number

FIGURE 9.—School gardens near the large cities, like this one at Helsinki, have been made an integral part of the national social program which aims at making Suomi one of the most literate, highly cultured nations of Europe. (Courtesy of the Finnish Legation.)

of piers so that vessels can load the timber directly from the railway trucks without being compelled to use lighters. The total length of the quays of the Sörnäs Harbor is at present (1928) about 1,000 metres, while the depth of water at the wharves varies from 12.5 to 20.5 feet (3.7–6.2 metres).

The Sörnäs Harbor also contains most of the tanks built for the storing of oil in the Helsingfors district. The space available for this purpose, however, is limited, and the depth of water at the wharves is insufficient for the large tankers, now used in the oil trade. In view of the continued and rapid growth in the use of oil for different purposes, the question of providing better facilities for the storage and distribution of oil in the port of Helsingfors has become urgent. Plans for a modern oil harbor have, indeed, been drawn up, but the site of the new constructions has not yet been definitely selected.

In the opposite direction from the center of the city is the new West Harbor. Though yet in course of construction it bids fair to become the most extensive and best equipped of all the harbors of Helsingfors. It will accommodate large ships and provide berths for the liners that trade to North America, Brazil, Argentine, and other lands beyond the ocean. The depth of water at its quays varies between 19 and 32 feet (5.7–9.7 metres), and the length of the quays completed amounts to 1,400 metres.

The West Harbor includes a large area set aside for the storage of coal. It is provided with modern appliances for the rapid discharge and handling of coal, and it has a quay of sufficient length to allow three or four steamers to unload at a time. In view of the fact that coal is gradually supplanting wood as fuel in the factories and furnaces of Finland, and that the yearly import of coal to Helsingfors already attains a million tons, the capacity of the central coal depot is considered too small. As a measure to improve it, the quay at the coal wharf will immediately be lengthened to admit more ships. The storage area, which measures about 25,000 square metres, suffices for the present.

At the south front of the city stretches the Sea Harbor. It has no deep water quays and is used only by rowing boats, yachts, and small coasting vessels trading among the islands and the adjacent ports of the mainland. They anchor inside a

group of small islands and ridges of rocks that surround this part of the headland at some distance from the shore. Outside stretches the open sea, broken by many dangerous shoals and shallows. To construct a real port in this part of the shoreline would entail very heavy expense in removing rocks, filling up large areas, building protective moles, and dredging.

Though thus already comparing in size and modern equipment with the foremost ports of the Baltic, Helsingfors contemplates large extensions of its harbors. It is proposed to spend no less than 216 million marks (more than $5,000,000) in improvements and new constructions in the port during the next period of five years (1930–1934). Most of the existing harbors will be enlarged and provided with new quays, more extensive railroad tracks, and modern machinery, and a new harbor will be constructed at Hertonäs, a place lying at some distance to the northeast of the city. The new basin will cater especially for the export trade that goes through Helsingfors. It will be remembered that as regards the export of wood and paper, the capital is still second to Kotka and Viborg. Within leading commercial circles of Helsingfors there is some hope that the new harbor will enable the capital to wrest from these ports part of their trade and make it also supreme in this respect.

The length of the deep water quays of Helsingfors in 1927 was about 4,000 metres, while the total length was somewhat over 7,000 metres. Of railroad tracks and sidings there were 35,000 metres in the different harbors. The floor area of the sheds and warehouses in the port amounted to 98,200 square metres, and the total area of loading places was 301,500 square metres.

In describing the harbors of Helsingfors it must be remarked that the city does not supply the port with warehouses. These are provided for by a special corporation, the Helsingfors Warehouse Company, in which the city, however, is the principal shareholder. The company at present owns fifteen general warehouses, together occupying a floor area of 67,000 square metres. The central warehouse, which also contains the offices, is a magnificent building in close proximity to the custom-house of Helsingfors. The company has the rights of a free port. They can keep their goods in the warehouses two years without passing them on to the custom-house, repacket the wares in smaller parcels, or reship them without paying duty, as they find convenient.

The growth of the traffic in Helsingfors is seen from the following figures, which give the net register tonnage of ships entered and cleared in foreign trade:

Year	*Tonnage*
1925	1,621,275
1926	1,578,088
1927	2,303,252
1928	2,725,065

If the local and coastwise traffic be included in the figures, the total tonnage of ships using the port of Helsingfors during 1928 was 3,953,000 tons, an amount that compares favorably with those of the other large ports of northern Europe.

Turku (Åbo)

Åbo occupies the second place among the ports of Finland only with regard to the import of foreign goods. Yet it is convenient to treat it immediately after Helsingfors, since, in many respects, the geographical posi-

tions of the two cities are alike. Helsingfors is situated on the south coast at a point from which the distance across the Gulf of Finland to Esthonia and its capital Reval is the least possible. Åbo has a like position with regard to Scandinavia and especially to Stockholm, the capital of Sweden. The general passenger traffic to and from Finland consequently goes through these two ports, which in this respect are of equal importance. Both cities are surrounded by populous and fertile districts, but while the upland of Helsingfors is expanding, that of Åbo is stationary or diminishing. The railroad communication of Helsingfors is much better than that of Åbo, whose endeavors to improve its connections have been constantly and successfully counteracted by Helsingfors. Centralization of trade by means of a few large coöperative societies has been very unfavorable to Åbo, and the diverting of a great part of its export trade by the selling organizations of Helsingfors, which now manage the export of the standard products of Finland, has been still more detrimental to the city's commercial progress. Åbo, nevertheless, retains much of its former importance, and has undoubtedly a bright future, provided the resistance of Helsingfors can be overcome and a greater scope be left for individual initiative and local enterprise.

Åbo has a very favorable position in the southwestern part of Finland, almost exactly at the middle point of the coastline. Though not situated on the open sea, it is easily accessible from different directions by deep channels that lead past the islands. There are no less than four main entrances with a depth of 30 feet or more, and, in addition, several shallower passages accessible for smaller craft. These channels can, as experience shows, be kept open by ice-breakers even in severe winters, when ports on the open sea are blocked by masses of drifting ice. Navigation often goes on at Åbo, while it is closed at Helsingfors and other eastern ports.

Åbo is a city of very old standing, the history of which goes back to pre-Christian times. The original port, which in the chronicles was said to be frequented by foreign merchants, was situated at a small river some distance from its mouth. The river still forms an important part of the harbor, though it is now used only by small passenger steamers, coasting vessels, and cargo boats of moderate tonnage. The depth of the river varies between 2.6 metres in the upper part and 4.8 metres lower down, where the ship-building yards and slipways are located. Both banks of the river, whose mean breadth is 70 metres, are to a great extent provided with magnificent stone quays, which afford plenty of space for a great number of vessels. Warehouses and sheds are found in the vicinity of the custom-house, before which most of the coasting steamers lie loading and discharging.

The modern harbor of Åbo is situated just outside the mouth of the river. In outline it is very simple, mainly consisting of two quays meeting at right angles. The one facing south is regularly used by steamers in foreign trade. It has a length of nearly 1,600 metres, and the depth at it varies between 5.1 and 6.5 metres (17–22 feet). It is provided with electric cranes, warehouses, and sheds for different purposes. The quay facing north-west is principally used by steamers loading sawn tim-

FIGURE 10.—In Turku (Åbo), the former capital of Finland, the forest and the sea play as prominent a part in the lives of the peoples as they did elsewhere in Suomi. (Courtesy of the Finnish Legation.)

ber. It is also the regular berth for the mail and passenger steamers plying on the Stockholm-Åbo line.

The space enclosed between the two quays and the old Castle of Åbo, an area of about 450,000 square metres, contains a number of warehouses, belonging to the municipality or to private firms. Those of the city together have a floor-area of 20,000 square metres, while the private warehouses represent a somewhat smaller amount. Besides these buildings the harbor area contains large spaces for the storing of timber, coal, and other heavy goods. There are 10,000 metres of railway tracks and two cisterns for fuel oil. In view of the growing demand for this article and in consideration of the fact that the old tanks have a very unsuitable and even dangerous position, it has been decided to construct immediately a new oil harbor some distance to the west of the present site. It will be spacious and allow large tankers to come alongside the wharf and discharge by short pipe-lines.

Outside the harbor extends the roadstead of Åbo. It is almost landlocked and has a depth of 24 feet (7.3 metres). It is used principally by sailing ships and steamers loading timber from barges There is room enough for ten vessels to be moored at a time. The entrance to the harbor is somewhat narrow, but in view of the fact that there is no tide or surf nor any dangerous reefs, it can be passed without difficulty even by large steamers.

The total length of the quays of Åbo is about 7,100 metres, or almost exactly the same as that of Helsingfors. As regards deepwater quays, there is, however, a great difference in favor of the latter city, which has three times as many as Åbo. The proportion between the warehouse facilities of the two ports is the same.

Though the port of Åbo in its present shape suffices for the actual traffic, plans have been prepared for a

considerable extension of the harbor. A large basin with deep water quays will, according to the design, be constructed in close proximity to the present harbor. The work entails much dredging and filling up, but it will, when completed, more than treble the capacity of the port. The new oil harbor, now in course of construction, may be considered as a part of this important undertaking. Should the traffic of Åbo continue to grow in the future, there is still left a wide area very suitable for harbor constructions on a large scale.

As already stated, it is as a port of import that Åbo is prominent. The value of the goods imported by this port, expressed in per cent of the total import of Finland, has varied between 20.4 and 13.4 during the last decade, showing a decline since 1926.

The amount of shipping in the port of Åbo is illustrated by the following figures, which give the net register tonnage of ships entered and cleared in foreign trade:

Year	*Tonnage*
1925	1,009,781
1926	891,885
1927	956,552
1928	1,067,833

If the coasting vessels are included, the total amount of ships entered and cleared in the port of Åbo during the year 1928 was 1,845,305 tons, or about half that of Helsingfors.

Vaasa (Vasa)

Vasa belongs to the same natural group of ports as Åbo and Helsingfors. It plays a much more prominent part in the import than in the export trade of Finland. It is the largest and most central port on the Ostrobothnian coast and has a fertile and populous upland. The city itself is the seat of considerable industry, and it has several important factories, including one of the largest flour mills in Finland. The import consists of cotton, grain, chemicals, coal, and liquid fuel, while the export is made up of sawn timber, cellulose, meat, and livestock.

Vasa is situated some distance to the south of the Quarken, the narrowest and most dangerous part of the Gulf of Bothnia. Its harbor is easily accessible and can be kept open for navigation over a longer period than the ports situated farther to the north. Regular lines of steamships connect the city with the principal ports on the Baltic and the North Sea coast. The railroad connections of the city with the interior of the country are not at present satisfactory, but there is some prospect of improvement by the construction of a new line.

FIGURE 11.—A medieval cathedral of Turku, one of the graceful, national buildings of Suomi. (Courtesy of the Finnish Legation.)

The port of Vasa consists of an inner harbor, which borders the city on the west, and an outer harbor, which is built on an island, connected with the city by an embankment. The former serves the local import, while the latter is used by steamers loading sawn timber and other products of the wood-working industry. The depth of water in the inner

harbor is 15 to 17 feet, while the outer harbor is accessible to ships drawing 23 feet. Plans of improvement both of the inner and the outer harbor have been worked out, though want of means has hitherto prevented their execution.

To illustrate the amount of traffic in the port of Vasa it might be mentioned that the tonnage of ships entered and cleared in foreign trade during the year 1928 was 375,347 tons, while the total tonnage according to the port authorities amounted to 444,063 tons.

Viipuri (Viborg)

While the importance of Helsingfors, Åbo, and, in a less degree, of Vasa is mainly due to their passenger traffic and large import, the position of most of the other ports of Finland depends on the export of sawn timber and other articles manufactured from wood. There are a number of small coast towns, such as Hamina (Fredrikshamn) and Lovisa (Loviisa) on the Gulf of Finland, Rauma (Raumo) Gamla Karleby (Kokkola), Jakobstad (Pietarsaari) and Kemi on the Gulf of Bothnia, all of which owe their commercial prosperity almost exclusively to this trade. This, however, is only to a certain extent true of the three largest timber ports, Viipuri (Viborg), Kotka, and Pori (Björneborg), for each of these has a considerable and growing import trade. Our remark applies especially to Viipuri, which is a city of 65,000 inhabitants with a large industry and an extensive upland. With respect to the import, it is indeed the third port of Finland. As to shipping, it is the second, being surpassed only by Helsingfors. In its export of sawn timber it is the first, not only in Finland but on the whole Baltic coast, with the sole exception, perhaps, of Leningrad.

Viipuri is a very old town and has been the commercial center of Carelia for many centuries. Since the opening of the Saima Canal, it has been in direct communication with the large Eastern lake system. This comprises not only thousands of lakes, but extensive forests and powerful waterfalls, generating cheap electrical power for the numerous industrial establishments in the district. Most of these are sawmills and factories for the manufacture of paper, cardboard, and cellulose, but there are also chemical and mining works, machine shops, and shipbuilding yards. Communication by water is very good within the district, and there is an extensive railroad system, the center of which is Viipuri.

The port of Viipuri consists of two ports: the city harbor, which borders the city on two sides, and the outer harbor of Uuras (Trångsund), where large ships anchor to discharge or, more frequently, to load. The former is divided into two basins by a drawbridge. The inner or North Harbor is mostly used by small steamers, tugs, and barges, coming through the Saima Canal or loading timber from railroad trucks, arriving from distant sawmills. It has a depth varying between 2.5 and 4.2 metres (8.5 to 14 feet), and its quays have a length of 2,460 metres. There are 7,000 metres of railroad tracks and sidings and six warehouses and sheds with a floor area of about 5,000 square metres. The total space available here for timber and other heavy goods measures about 30,000 square metres.

The South Harbor provides berths for coasting vessels, sailing ships, and

cargo liners, frequenting the port. It has of late undergone many improvements and extensions. Its quays have been lengthened from 460 to 1,250 metres, its warehouses enlarged from the original floor area of 1,800 to 12,700 square metres, and its open spaces for the storage of goods have grown from 4,000 to 75,000 square metres. Movable cranes and other mechanical appliances, necessary in a modern port, as well as electric light, have been introduced. The depth of water at the old quay is 4.6 to 4.9 metres (15 to 16 feet), while at the new port there is no less than 6.4 metres (21.5 feet) of water. The depth ultimately aimed at is 7.6 metres (25.5 feet), which will allow the largest steamers trading in the Baltic to get alongside the quay.

Still more extensive works of improvement have been carried out at Uuransaari. The entrance to the harbor from the sea has been deepened to 7.6 metres, and two basins for ships have been dredged out, the one to a depth of 6.4 metres, the other to 7.6 metres. Moreover, piers and moles have been built, new tracks laid out, and in every way the loading of timber has been facilitated. The harbor has been connected with the city by a direct railroad line, and the channel from Uuransaari to the south basin of the city port, originally very shallow, has been dredged to 6.4 metres.

The extensions and improvements hitherto carried out in the port of Viipuri have entailed an outlay of 40 million marks, or about $1,000,000. But the goal has not yet been reached, and the work is still progressing. When completed, Viipuri will no doubt be one of the largest and best-equipped ports on the Baltic, able to cope with much more traffic than that handled at present.

The importance of Viipuri as a port is clearly seen from the fact that the tonnage of the ships entered and cleared in foreign trade at the port, including the harbor of Uuras, during 1928 was 2,101,819 tons, while the total tonnage of all vessels using the port was 3,282,113 tons.

Kotka

In contrast to Viipuri, Kotka is a new town. It was founded as late as 1871 on an island at the mouth of the Kyminjoki River. This is the outlet of the Central lake-system of Finland and contains many powerful cataracts, most of which are now harnessed for generating electricity. In the year 1878, when the new city received its charter, there were already eight sawmills. The subsequent rise of Kotka to be the first port of Finland with regard to the amount and value of its export coincides with the growth of industry in the valley of the Kyminjoki. This is probably now the most important industrial district in Finland. It contains several of the largest power stations, and the amount of horsepower generated in the Kyminjoki is greater than that produced anywhere else in the country, except perhaps Imatra. The industries represented are the same as those found in the district of Viipuri, but the industrial units are, as a rule, much larger in the surroundings of Kotka. The sawmills near the city are the largest in Finland, and the papermills of Kymmene, Kunsankoski, and Voikka together represent an output of paper scarcely equalled anywhere in Europe.

The growth of Kotka as a port has been much stimulated by the con-

struction of the railroad line to the Konvola Station on the main line between Helsingfors and Viborg. Kotka thus became the natural outlet for a vast region in the middle and the northern part of Finland. The city naturally seeks to extend its upland still further, and there is a keen rivalry on the one side between Kotka and Viipuri, on the other between Kotka and the ports on the Gulf of Bothnia. Moreover, the progress of Kotka is not viewed with satisfaction in Helsingfors, the aim of which is to concentrate more and more of the traffic and shipping of Finland on its own port.

The size of the port of Kotka is not commensurate to its importance. This depends mostly on the fact that many of the large sawmills in the vicinity of the city have their own roadsteads, where ships can anchor and load without entering the port itself. Moreover, for efficiency and work accomplished, Kotka is considered to be one of the best ports on the Baltic, and its quays and loading places are always used to their utmost capacity during the shipping season. This used to commence in the middle of May and close at Christmas, but navigation is now kept up over a longer period with the aid of ice-breakers.

The harbor of Kotka is safe and deep, but the quays are not yet of sufficient length to admit of a systematic division of labor, such as is being carried out in the port of Helsingfors. The quays have a total length of 2,663 metres, but only at the mole, which measures 600 metres, is there sufficient water (19 to 23 feet) for large ships. The warehouses and sheds in the port occupy 6,668 square metres, and there are 7,000 metres of tracks and sidings.

No extensions of importance have been added to the port during the last fifteen years, though its efficiency has been greatly increased by the introduction of modern machinery. Large additions are, however, contemplated, and a comprehensive plan of improvement has already been adopted by the city authorities. It includes the complete rebuilding of the old quays and the construction of two new moles. There will be a uniform depth of water of 7 metres (23 feet), allowing all but the very largest steamers to dock alongside the quays.

These extensions will, it is believed, suffice for many years. Should the traffic, however, continue to grow in the future, new harbors can easily be constructed both on the east and west side of the isle of Kotka, though the cost of these constructions would be very considerable.

To complete our picture of the traffic and shipping of Kotka, we should like to add some figures published in 1928 by the Board of Navigation. The tonnage of the ships entered and cleared in foreign trade at the port amounted to 1,853,278 tons, and the tonnage of all vessels using the port was 2,119,912 tons.

Pori (Björneborg)

Pori, whose old Swedish name is Björneborg, is the third of the large timber ports of Finland. Its geographical position and economic function is very similar to that of Kotka or Viborg. It is situated at the Kokemäenjoki (Kumo elv), which is the outlet of the western lake-system of Finland. This is smaller in extent than the Central and Eastern basins, but its economic importance is probably greater than any of these. It contains some of the most fertile and

populous regions of Finland as well as several industrial centers, the most important of which is Tampere (Tammerfors).

The city of Pori, which has a population of about 20,000 inhabitants, is an old trade center. In the middle ages it was situated farther up the river, but the rising of the land and the silting of the river has, several times, necessitated a removal of the settlement downwards. The present site is about 17 miles from the sea. Here are several large sawmills and works for the manufacture of paper and cellulose, cottonware and machinery, besides many smaller factories.

Moving up the river valley from Björneborg, we pass several power stations and industrial establishments and finally reach Tammerfors (Tampere). This was until recently the largest industrial city of Finland with respect both to the quantity and value of the goods manufactured. It has now been surpassed by Helsingfors, but still retains its leading position in several important branches of industry, such as the manufacture of cotton goods, cloth, and shoes.

The raw material and articles, as cotton, coal, and chemicals, required by the industries of Tampere, are imported partly by way of Helsingfors or Åbo, partly via Pori (Mäntyluoto). There is a direct line between the two cities, and Pori may thus be considered as one of the ports of Tampere. Another railroad, leading from Pori to the station of Haapamäki on the main line from Helsingfors to the north of Finland, is in course of construction. It is built especially to facilitate the exploitation of large forests, hitherto almost inaccessible.

Pori thus has better communication with the interior of the country than its principal competitor, Åbo. It is true that the river Kumo is not navigable. But it has, nevertheless, great economic importance, because the logs required by the factories of Pori are floated down the river. There are also valuable fisheries, and salmon, both fresh and cured, is one of the articles of export from Björneborg.

The port of Björneborg consists of three parts: The river port at the city, the roads of Räfsö (Reposaari), and the quays and mole on the Mäntyluoto Island. The city port, which is only used by coasting vessels and barges, consists of stone and wooden quays, having a total length of 520 metres. The depth of water at the quays and in the river is 3.4 metres. Ships of large or even moderate tonnage cannot therefore reach the city from the sea. Formerly they used to anchor in the Roads of Räfsö, an island outside the mouth of the Kumo River, where there are 9 to 10 metres (30 to 33 feet) of water. It must be remembered that the loading of wood was mostly done from barges, which were brought to the ship's sides by tugboats. When this manner of loading was abandoned and steamers began to take the wood directly from railway trucks, deep-water quays became necessary. These were constructed on the isle of Mäntyluoto, which lies at the open sea some 20 kilometres (12 miles) from Pori. The depth of water at the quay is 3.1 to 5.1 metres (10 to 17 feet), and at the mole 7.1 to 8.1 (23.5 to 27 feet). The warehouses and sheds have a floor-area of 7,500 square metres and the loading areas measure together 70,000 square metres.

Because of its position at the open sea the harbor of Mäntyluoto is less obstructed by ice than the other Finnish ports on the Gulf of Bothnia, and navigation is, as a rule, closed only for short periods in February and March.

The tonnage of the ships entered and cleared at this port, including Räfsö and Mäntyluoto, during the year 1928 was 452,984 tons, while the total traffic amounted to 642,885 tons.

WINTER PORTS AND WINTER NAVIGATION

In view of the northerly position of Finland it is natural that the waters bordering the coasts of the country should be regularly frozen over in winter. The amount of ice formed, however, varies much from year to year and from place to place. In the inner parts of the Gulf of Finland the freezing process begins at the end of November, and by the middle of December navigation ceases at Viborg and Trångsund. The ports remain closed until the beginning of May. At Kotka the break in navigation caused by ice obstruction is somewhat shorter, commencing on an average on the twentieth of December and lasting until the end of April. At Helsingfors navigation usually ceases soon after Christmas and recommences at the end of April. The port of Åbo is closed for about the same period, viz., from Christmas to the middle of April.

In the Gulf of Bothnia the conditions for navigation in winter time are less favorable, except as regards the ports situated at the southern end of the Gulf. The harbor of Mäntyluoto, which is built on the open sea, is usually accessible till the end of January and sometimes remains open throughout the winter. But farther north the ice conditions are more severe. Thus the port of Vasa regularly freezes at the end of November and remains closed until the beginning of May. In the northern part of the Gulf of Bothnia the ports are icebound for almost half a year. Thus at Oulo (Uleåborg) navigation ceases on the sixteenth of November, on an average, and does not open until the twenty-fifth of May.

FIGURE 12.—An ice-breaker, keeping a Finnish port open in winter, when otherwise all commercial activity would cease. (Courtesy of the Finnish Legation.)

The dates given above are calculated from observations made during several decades. They refer to a time when ice-breakers were not yet available. The introduction of the ice-breaker in the last decade of the nineteenth century marks a turning point in the history of Finnish navigation and commerce. It was now found that some of the western ports, like Hangö and Åbo, could be kept open all the winter in normal years and that navigation could be materially lengthened at several of the other ports, such as Helsingfors, Kotka, Rauma, and Vasa. In view of the fact that a considerable part of the export of Finland consists of agricultural products which must be exported in fresh condition, it is readily seen that this meant a great

advantage to the foreign trade of the country. A short account of the development of winter navigation on the Finnish coast will, therefore, merit attention.

The first effort to overcome the ice obstruction and establish communication between Finland and foreign countries by steamers running during the winter was made in 1877, when the steamer *Express* was dispatched from Hangö to Stockholm. The port of Hangö is situated on a headland which stretches far out into the Baltic. The sea at this point of the coast is generally open in January, and it is not until February that ice is formed in appreciable quantities. Hangö is the terminus of an important railroad from the interior of Finland, and it is one of the few ports owned and managed by the State. Originally it consisted of a single stone pier, but it has later undergone large extensions and improvements and now ranks among the best-equipped ports on the Baltic. There are two massive piers, provided with spacious sheds and modern machinery for the rapid handling of goods. The quays have a length of 1,500 metres (4,900 feet), and the area of the warehouses measures about 60,000 square metres. The principal basin is wide and safe and has a depth of 6.4 to 9 metres (21.5 to 30 feet). Hangö is the most important winter port of Finland, especially as regards exports. The greatest part of the butter made in Finland is shipped from Hangö, and the quantities of wood paper and cellulose passing through this port are steadily rising.

The enterprise of 1877, conceived and carried out by the energy and perseverance of a single person in face of difficulties of every kind, showed beyond doubt that winter traffic between Finland and foreign countries was possible in normal years. During the sixteen winter seasons that the *Express*, a steamer of only 298 tons register, kept up a weekly or biweekly service between Hangö and Stockholm comparatively few trips had to be abandoned owing to ice obstruction. During no less than eight winters every trip was carried out without a hitch, during two winters there were only small irregularities, while in six winters there were longer periods of stoppage.

In view of the experience thus gained it was natural that the winter navigation based on Hangö should be extended. In the year 1886 a new connection was formed with Lübeck, the old Hansa town and still one of the leading German ports on the Baltic, and in the following year the United Steamship Company of Copenhagen established a line between this port and Hangö. Finally in 1890 the Finnish Steamship Company of Helsingfors had two powerful boats built for their main line Helsingfors-Copenhagen-Hull, which during the cold months has Hangö for its terminus. They proved very successful and materially helped to develop the trade between Finland and England.

From the short account of the first stage of the winter traffic on the Finnish coast given above, it will be seen that ice-breakers were not at first available at Hangö. The steamers frequenting the port had to rely on their own power in forcing their way through the icefields. It was, however, soon realized that much time and money would be saved if there were an ice-breaker to assist the steamers entering and leaving the harbor. After much deliberation

and study in Germany and Scandinavia, where ice-breakers had long been used, it was resolved to proceed to the construction of such a ship. In 1890 the new ice-breaker was ready for service. Its length was 47.5 metres, its breadth 11 metres, and its draught 4.8 metres. It had a single screw, driven by an engine of 1,200 horsepower. The vessel proved efficient enough in ordinary ice, but was almost helpless in the heavy icepacks and icewalls sometimes formed outside the harbor by southeasterly winds. In view of this fact it was decided to build a more powerful ice-breaker, and in 1895 an expert was sent to America to study the vessels used on the Great Lakes during the winter season. This report being favorable, a new ice-breaker, designed on the American plan with two propellers, was ordered from the famous yard of Messrs. Armstrong, Whitworth & Co. at Newcastle. It was to have a length of 61.5 metres, while the breadth was to be 13 metres and the draught 5.6 metres. The machinery consisted of two engines, developing together 2,600 horsepower on normal, and 3,000 on forced pressure. In 1898 the new ice-breaker was completed and began work at Hangö. It proved very efficient and fully answered all the expectations of its builders. A second vessel of the same type, though somewhat larger, was subsequently added to the fleet of ice-breakers belonging to the Finnish State Government.

For almost twenty years Hangö served as the only winter port of Finland. But during the last decade of the nineteenth century Turku (Åbo) began to compete with it. In view of the fact that this port is situated at a considerable distance from the open sea, it was generally thought that it would not be suitable for winter navigation. But experience soon showed that the ice lying between the islands was not so heavy as that formed in the open sea and that it could easily be broken not only by ice-breakers but also by passenger and cargo steamers of moderate strength and power.

The winter navigation of Åbo commenced as a local line of steamers, connecting the Åland islands, (situated halfway between Finland and Sweden), with the mainland. Later this line was extended to Stockholm, and in 1897 a new company was formed in Åbo with a view of starting a first-class mail and passenger service between the two ports.

In spite of some reverses and accidents, in which, however, no lives were lost, the new line soon became very popular. To facilitate navigation and ensure regularity even in severe winters, the company acquired a powerful ice-breaker, which later passed into the ownership of the city of Åbo. After a long and severe struggle between the competing companies, the old route from Hangö to Stockholm was abandoned and the steamers transferred to the Åbo line, which now forms the main connection between Finland and Sweden. Hangö, however, retained its position as winter port for the steamers running on lines to Germany, Denmark, England, and other western countries. Since the war it has also become the winter terminus of the American liners trading in the Baltic. Åbo, in addition to the mail steamers on the Stockholm line, is much frequented by Finnish and German cargo liners. During the past two years the traffic has, however, been diminishing, owing, partly to the policy of the State Railways, who prefer Hangö to Åbo-

partly to the trade depression, which has been very severely felt at Åbo.

The two cities just mentioned, Hangö and Turku (Åbo), may be considered as the real winter ports of Finland. There are, however, other places which can be kept open for navigation at least during part of the cold season, and which, in some respects, are better situated for the export trade. It must be remembered that the basic industries of Finland are located in the central and eastern parts of the country at a considerable distance from the old winter ports. In spite of lowered tariffs, accorded to shippers during the winter months, the expense of railroad conveyance has meant a heavy burden on the export trade. There has, consequently, been a widespread dissatisfaction with the policy of the State to centralize exports, and a demand to keep more ports open by ice-breakers. The cry has been especially loud from the side of Helsingfors, which, in addition to having the largest import in Finland, endeavors to increase its export by all means. After much deliberation the Finnish parliament finally granted the necessary money for the construction of two more ice-breakers. One of these, the "Jääkarhu," was comparable in size and power with the famous Russian ice-breakers. According to the design its length would be 75 metres, its breadth 19 metres, and its draught 6.5 metres. It was to have three propellers, one at the bow and two at the stern, driven by engines developing 9,000 horsepower at forced draught. In March, 1926, the new ice-breaker was ready for service and began work at Hangö. Later it has, however, mostly been employed at Helsingfors and has succeeded in keeping that port open during mild winters.

FIGURE 13.—One of the better farms of Southern Finland. Wherever possible, the Finns cultivate their land, but their northern location with its short growing season, low-altitude sun, and acid soils, is not conducive to a wide extension of agriculture. (Courtesy of the Finnish Legation.)

As for the ports situated to the east of Helsingfors, like Kotka and Viborg, it would be difficult and entail heavy expense to try to keep them accessible during the whole winter. But the period of navigation has been materially lengthened, especially at Kotka, which is near the open sea and can be attained by different routes. The same refers to the ports of Raumo and Mäntyluoto

on the west coast, which, however, are more liable to be closed by drifting icefields.

From the short account of the winter navigation given above, it will be seen that the number of ports kept open during part or the whole of the cold season has steadily been rising. This has necessitated the construction and maintenance of a whole fleet of ice-breakers, comprising at present seven units. In addition to these, every city partaking in the winter traffic provides its own ice-breaker for mooring, turning, and removing the ships within the harbor area.

GENERAL SURVEY OF FINNISH PORTS

In the previous sections of the article, the author has tried to give an account of the commerce and shipping of Finland so far as they depend on the ports of the country. With this in view the principal ports have been described and the author has tried to give a correct and impartial picture of their capacity for traffic. In order to get a clearer idea of the relative importance and standing of the several ports a table giving the rank of each of them, calculated from the amount of foreign shipping cleared during the years 1928, 1929, 1930 is added.

Rank	*Port*	*1928* *Tons*	*1929* *Tons*	*1930* *Tons*
1	Helsinki (Helsingfors)	2,725,065	2,428,376	2,789,811
2	Kotka	1,853,278	1,980,316	2,237,385
3	Viipuri (Viborg)	2,101,819	1,939,635	1,875,730
4	Turku (Åbo)	1,067,833	985,757	990,298
5	Koivisto (Björkö)	762,107	624,696	497,630
6	Pori (Björneborg)	452,984	465,619	460,758
7	Hangö (Hanko)	477,154	508,040	329,427
8	Gamla Karleby (Kokkola)	415,519	385,098	355,397
9	Kemi	361,563	357,214	388,908
10	Vaasa (Vasa)	375,347	341,910	327,784
11	Rauma (Raumo)	341,959	297,108	319,632
12	Hamina (Fredrikshamn)	305,573	245,639	190,875
13	Loviisa (Lovisa)	230,581	227,768	177,608
14	Pietarsaari (Jakobstad)	263,442	187,579	172,492
15	Raahe (Brahestad)	154,494	154,693	120,072
16	Oulu (Uleåborg)	118,174	94,769	122,477
	Other ports	1,478,218	1,486,066	1,376,670

From the table it will be clearly seen that the ports of Finland naturally form a number of groups or classes. To the first belong Helsinki (Helsingfors), Kotka, and Viipuri, which may be designated as the three great ports of Finland. The differences between the figures for each are comparatively insignificant, though Helsinki (Helsingfors) easily leads the group. The order of the two others is somewhat doubtful, Viipuri being second in 1928, Kotka in 1930. During the period comprised in the table, the tonnage of Viipuri has decreased, while that of Kotka has been constantly growing.

But this development depends on circumstances which are not sure to continue. It must also be observed that the port of Viipuri has of late undergone great improvement and that its upland is richer and its resources more varied than those of Kotka.

To the second group belong the six ports of Pori, Hangö, Gamla Karleby, Kemi, Vaasa, and Raumo, the figures for which vary between 460,000 and 300,000 tons in round numbers. With the exception of Hangö and Vaasa they are typical timber ports. This refers also to the last group, comprising the five ports of Hamina, Lovisa, Jakobstad, Oulu, and Raahe, which have shipping varying between 200,000 and 150,000 tons.

Between the first and second class there is a wide gap, which, however, is partly filled by the single ports of Turku (Åbo) and Koivisto. According to the table the shipping of Turku is only half that of Kotka or Viipuri. But the figures do not give a fair picture of the movement in the port. It must be remembered that the city of Åbo is the center of considerable local traffic by sea, which represents a comparatively larger amount of tonnage than that of any other port in Finland. The second intermediate place mentioned above is a government port, which mainly serves as an auxiliary timber outlet for the Viipuri district.

In addition to the ports mentioned in the table, there is a group of small coast towns, the foreign shipping of which in 1930 together represented 1,376,670 tons. The total foreign shipping of Finland in 1930 amounted to 12,732,954 tons.

AGRICULTURE OF THE SOUTHERN HIGH PLAINS[1]

J. Sullivan Gibson

SLOPING gently eastward from the foothills of the Rocky Mountains of the Southwestern United States is a tract of monotonously level and unbroken country called the High Plains. This great alluvian apron formed by strata laid down as a series of compound alluvial fans at the eastern foot of the Rockies, stretches eastward for a distance of more than three hundred miles with a very gentle and uniform slope of about eight or ten feet per mile. Much of the region has slightly rolling, and in places, broken relief; but nowhere is the variation in surface features great. Some parts form perfectly level and symmetrical plains the oneness of whose monotonous landscape is broken only by recent marks of civilized man.

The continental location of this region in the lee of the Southern Rockies, remote from the Atlantic Ocean and the Gulf of Mexico where much of the rain of the continent must have its origin, stamps it with a semi-arid climate whose rainfall is so scant and so unreliable as to repel all attempts at agricultural pursuits until the dawn of the present century. Vast stretches of deep, fertile soil, not timbered, to be sure, but clad in a drought-resistant species of short prairie bunch grass of good quality, furnished excellent grazing for the herds of the ranchmen who held undisputed title to the area until recent times.

[1] The writer wishes to acknowledge the assistance of Dr. V. C. Finch of the University of Wisconsin under whose supervision this paper was prepared.

Early in the history of the Middle West this fertile grassland issued a challenge which the new-comer could not ignore. Stronger and stronger grew the temptation to plant farm homes in the new land. Attempt after attempt was made, only to be blasted by the tragedy of drought. Untrained in the school of experience, the farmer-stockman from the more humid east was unable to cope with nature in a land of such limited rainfall; and had each failure brought utter discouragement, complete settlement would have been permanently delayed. But believing firmly in the potentialities of the new land, through successive trials resulting occasionally in success but more frequently in failure, man has triumphed. Broad tracts of fertile, level grasslands, once the scene of grazing herds of longhorn cattle, have in recent years yielded to the plow-share. Large fields of cotton, corn, and waving grain dominate the landscape. And the large scale system of agriculture now in vogue on the High Plains is producing and maintaining a thriving civilization with a newness and color all its own.

The wild plains of the last century are no more. The tragedy of Indian raids and the excitement of buffalo hunts have passed. The thrill of the round-up, and the many exciting experiences of cowboy life have done much to immortalize the western ranch; and though long to be cherished in the hearts of the hardy cattlemen, the typical western frontier has passed. With the passing of

the large cattle ranch of a quarter-century ago has come also the transforming of the rough, western ranch culture into a semi-western culture of farming and stock raising. The wire fence has to a great degree eliminated the range rider, and the settler devotes much of his time to the cultivation of crops. The amount of tilled land is steadily increasing and the significance of ranching is sinking year by year.

This is a land of large farms (Fig. 4). Two hundred to three hundred acres are often devoted to a single crop of cotton, while one may see several times this area in a single field of wheat. Extensive, large-scale methods are employed; and many farmers use large tractors or eight-mule teams for pulling large plowing and harvesting machinery (Fig. 5).

A considerable amount of grazing land is maintained and many cattle are raised in connection with farming. The branding pen has been converted into a feeding pen (Fig. 6); and this area, though predominantly farms, still produces a great deal of the meat raised in the southwest.

The light rainfall of from twelve to twenty-five inches per year, which soon soaks into the ground or is evaporated by the drying winds, renders the region treeless save for scrubby bushes and small trees along the courses of the streams. Road-building is an easy matter in a land with so level a relief and so light a rainfall; and a fairly good system of graded highways serves most of the area. Not all of the towns are served by railroads; but this is not a severe handicap, since ample truck and bus service is easily provided.

The uniform, rectangular pattern of the farm, pasture, and road, is carried out with no topographic interruption whatsoever (Fig. 7). Nor is there much rock to hinder the plow, and practically all the land is tillable. As the rainfall is so slight and the slope so gentle, there is very little washing or gullying; but on the other

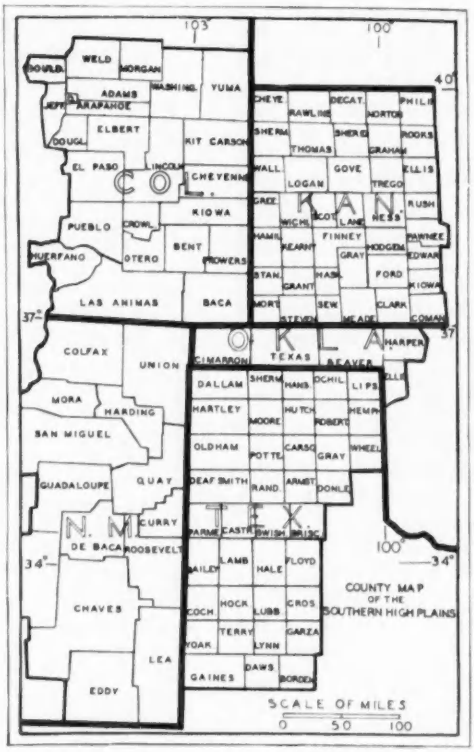

FIGURE 1.—The political subdivisions constituting the greater part of the Southern High Plains.

hand, this lack of drainage sometimes results in the forming of small lakes or ponds. These, however, are usually temporary, lasting for only a short time after the rain ceases.

REGIONAL BOUNDARIES AND SUBDIVISIONS

Although the term "High Plains" is applied to the treeless half of the Great Plains of North America, the division with which this paper deals includes only the southwestern part of that area. In many respects there is much uniformity throughout

the whole of the Great Plains, and any accurate subdivision of the region is very difficult. But there seems to be some justification for such a division; and for the purpose of this study fairly definite boundaries are recognized.

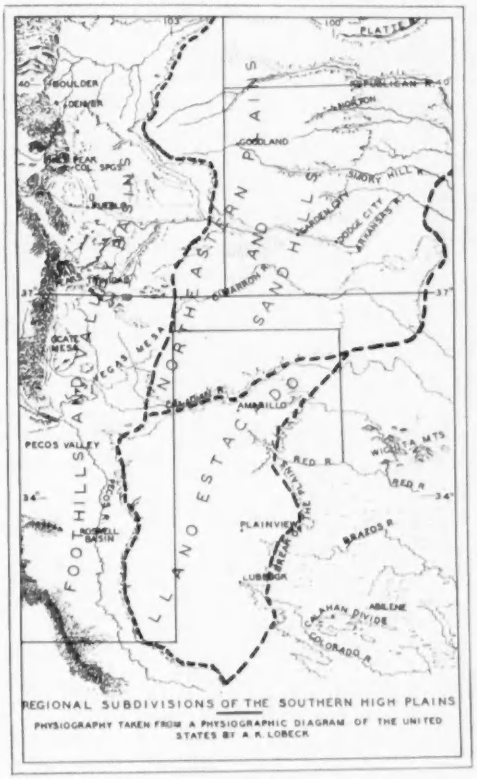

FIGURE 2.—The physical relationships of the regions of the Southern High Plains.

The Llano Estacado of western Texas and eastern New Mexico comprises the southern part of the area under consideration. This region has the most homogeneous surface of any Plain on the continent. Stretching for about 200 miles from east to west and 300 miles from north to south, it remains undrained and uneroded, with well-defined characteristics and, in places, clear-cut boundaries. On the southeast it is separated from the Edwards Plateau by a distinct escarpment, which extends unbroken for nearly 200 miles in a nearly north-south direction through western Texas, following closely the 101st meridian of west longitude (Fig. 1). This scarp, known locally by such names as the Cap Rock, Break of the Plains, etc., rises sheer from 300 to 600 feet above the level of the prairies to the southeast of it (Fig. 8). The general elevation of the eastern part of this region is about 2,000 feet. Although there is a gradual rise to the west from three to ten feet per mile, as far as the eye can see, the country appears perfectly level. So distinct is this escarpment that in very few places can one be at all in doubt as to whether he has reached the plains proper.

From the Canadian River northward this eastern escarpment becomes less and less distinct, spreading into a belt of broken relief over which the higher elevation of the plains to the west is reached at a much more gradual slope than the Cap Rock and the Breaks to the south produce. This transition zone is broad and in many places indistinct, and the plains to the west are less smooth than the Llano Estacado. The several streams which cross the eastern border have so thoroughly incised themselves that their work of erosion has greatly changed the upland surface, making an accurate boundary impossible. Two of these streams—the Canadian and the Arkansas—have their beginning in the Rocky Mountains to the west, and have incised deep, canyon-like gorges which extend the full width of the region.

A noticeable feature which to a certain extent is common to the eastern part of the High Plains province is the large size of cultivated area

to each farm (Fig. 9). With a uniform, level relief and a reasonably fertile, rock-free soil, a very high per cent of the land of the area can be cultivated; and added to this, the light and uncertain rainfall make conditions favorable for a rather extravagant system of large-scale farming. The farms here average in size well above those of the prairies farther to the east. In the eastern part of the region, with few exceptions, they average above 150 acres; and in the wheat-growing sections of northern Texas, Oklahoma, and Kansas they are much larger, averaging from 250 to nearly 500 acres. But in the western part of the region the rainfall is too light for much farming. Ranching is the only significant industry and the cultivated land is of minor importance.

Before reaching the Rocky Mountains the uniform topography of the High Plains is somewhat broken by the foothills and valley basins which fringe the great mountain range throughout its eastern margin. Numerous mountain detachments appear as inliers, often at considerable distance from the mountain proper. Occasional tongues of the sedimentary plain project far into the mountain mass; while in still other places the Rockies are reached over one or more terrace-like mesas which are separated from the High Plains to the east by a sheer, eastward-facing escarpment. Two of these—the Las Vegas and the Ocate—are of considerable size, and have a relief much like that of the Llano Estacado to the southeast. But much of this marginal area has lost its plains appearance and has a very broken and hilly surface.

The only south-flowing river of this region is the Pecos. Rising well up

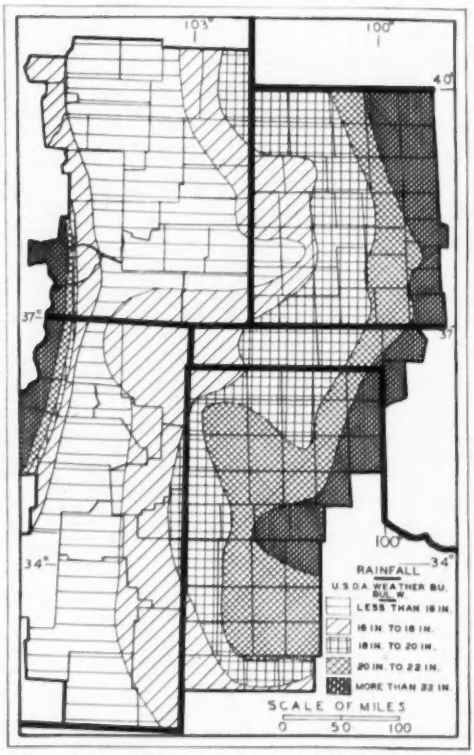

FIGURE 3.—The periods covered by the records of the various stations from which this map was made vary considerably in length. If authentic records for a sufficiently long period of time were available they would doubtless show less irregularity than shown by this map.

in the mountains just east of Santa Fé, New Mexico, it follows a southerly course through a broad basin-like valley to join the Rio Grande in the Edwards Plateau of western Texas. This depression, known locally by such names as Pecos Valley, Roswell Basin, and others, is separated from the Llano Estacado by a rather pronounced westward-facing scarp; while its western limit is the Rocky Mountains proper.

Farther to the north several small streams, tributaries to the Arkansas, have small yet well-defined, gorge-like valleys, and these, together with the numerous buttes and mesas which make up the Rocky Mountain foothills, present a rather rugged, hilly relief.

Uniformity of relief, climate, and soils make impossible any natural northern limit of the Southern High Plains; and hence the boundary chosen is more or less an arbitrary one. It is noted, however, that in practically all of Kansas which lies within the High Plains, together with a strip of country extending far to the interior of southern Colorado, wheat is the dominating crop. The wheat acreage throughout this area is much greater than that of any other crop; and in some counties it amounts to two-thirds or more of the total cultivated land. But in southern Nebraska and northeastern Colorado corn is predominant. A line continuous with the Kansas-Nebraska boundary seems roughly to separate these two great crops. From these criteria this line has been chosen as the northern boundary of the area for this study.

From the foregoing survey it appears logical that for the purpose of studying agricultural conditions, crop distribution, and farming tendencies on the Southern High Plains, the area might be considered under three main subdivisions: (1) the Llano Estacado of the southeast, (2) the broken plains and sandhills of the northeast, and (3) the foothills and valley basins of the west.

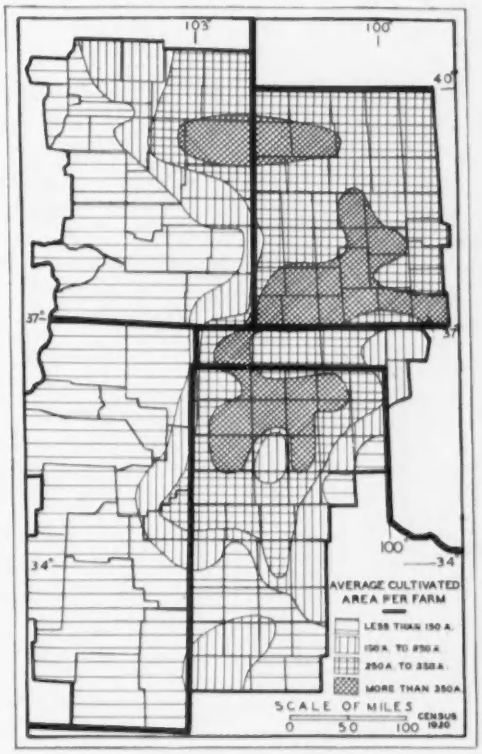

FIGURE 4.—The Southern High Plains is a section of large farms, characteristic of lands of deficient and untrustworthy rainfall.

LLANO ESTACADO

The monotony of the American High Plains reaches a climax in the Llano Estacado of western Texas. Throughout a great part of this area one is impressed with the levelness of its topography. Even the gentle, rolling surface which is characteristic of much of the High Plains region is lacking over much of this section; while in other parts this levelness is slightly interrupted by very gentle, billow-like swells, sometimes rising to elevations several feet above the general level. Shallow playa lakes which usually last for only a short time after the heavy rains, occupy many of the low, flat depressions while there are small permanent lakes or ponds, called buffalo wallows, in parts of the region. In spite of these minor irregularities the skyline of most of this area is everywhere the same. From almost any position the horizon appears as a low rim from which the land seems to slope very gently toward the observer. The gentle, eastward slope of from three to ten feet per mile is too slight to be readily detected, and the eye catches only the minor irregularities.

Such a landscape often continues

for miles without interruption save for the most minute variations of surface and soils, and for the mocking mirages which are so common in such a land. The deep, sandy loam soil is everywhere fertile; but the light rainfall, together with brilliant sunshine and blasting winds, limit the production of natural vegetation to a sparse cover of short prairie grass. And although until recent years ranching was the only industry there in vogue, the area is now the scene of both grazing herds of cattle and growing fields of cotton and grain.

FIGURE 5.—Preparing land for planting on a large farm of the South Plains. The tractor has almost supplanted horse and mule power in some parts of this region. (Courtesy of the Lubbock Chamber of Commerce.)

For two hundred miles from north to south and nearly as far from east to west this land extends, unbroken and without timber. From the Canadian River southward to the northwestern limits of the Edwards Plateau, and from the eastern Cap Rock escarpment to the rim of the Pecos Valley, the country continues with little diversion. Here an area of 20,000 square miles is almost untouched by erosion. The Canadian River has cut a deep canyon from near its source in the Rockies entirely across the region; and this feature stands as a land mark, completely separating this area from the plains and prairies to the north. This gorge-like valley nowhere more than a few miles in width, reaches a thousand feet below the general level of the upland surface; and along its walls are exposed Permian limestones, clays, shales, and sandstones, and the Triassic red clays and sandstones which underlie the Miocene sands and gravel extending over practically all of the region. Such a physical feature naturally presents a handicap to all types of human progress; and much of the zone through which it passes has, by excessive erosion, been rendered almost valueless as a farming area (Fig. 9). Several other streams, tributaries of the Red, the Brazos, and the Colorado Rivers, have to some extent marred and scalloped the eastern border. Seventy-five miles south of the Canadian River the South, or Prairie Dog Fork, of Red River has worked headward in a northwest direction into the heart of the region, terminating in the deep, narrow Palo Dura Canyon near Canyon City,

twenty miles south of Amarillo. Still farther south headwaters of the Brazos and the Colorado have cut peaked scallops in the eastern face. But so youthful is the erosive work of these streams that little of the upland surface has been disturbed; and since all of them are confined to the northern and eastern margins of the region their chief effect is to produce a ragged, scalloped border.

This region has all the characteristics of a continental climate. Often the blasting winds of the winter blizzards, sometimes accompanied by drifting snow, send the mercury to five, ten, and occasionally twenty degrees below zero. February is the coldest month, and throughout the region sub-zero temperature is usually recorded; while the absolute minimum is minus twenty-three, recorded at Tulia, Swisser County, Texas. The summers are warm but not oppressively hot. Throughout the area, day temperatures of from 105 to 110 degrees have been recorded; but the nights are cool. With the breeze which usually blows and with the low relative humidity, even the high day temperatures are not disagreeable. Although the difference in temperature extremes is about 130 degrees, the average difference between winter and summer means is about 36 degrees. Records for Amarillo show a January mean of 36 degrees and a July mean of 75

FIGURE 6.—Hereford yearlings being fed for market on a South Plains stock farm. This region sends relatively few strictly range grown cattle to market; most of them are finished on corn and other grains grown in the region. Notice a few hogs which eat the feed wasted by the cattle. (Courtesy of Lubbock Chamber of Commerce.)

This region has a variety of soils ranging from the weak sands of the scattered sand-dune areas to deep, fertile chocolate-brown and black loams. But the most extensive type of soil is the Amarillo clay loam. This ranges from a silty and even sandy soil to a medium light clay texture and consists of a surface of four to eight inches, brown to reddish in color and a dark reddish-brown subsoil. It occupies most of the Llano Estacado and considerable area north of the Canadian River, and is strong and quite productive when properly cultivated and given sufficient water.

FIGURE 7.—A scene typical of the High Plains. A rectangular pattern of fields, pastures, and roads characterizes this region. (Courtesy of Lubbock Chamber of Commerce.)

degrees; while in the southern part of the region these means run from 4 to 6 degrees higher.

The average annual precipitation ranges from 15 or 16 inches in the west to 24 or 25 inches in the east (Fig. 3). While these amounts are not large, they are very favorably distributed for agricultural purposes, 65 per cent of the total occurring, usually in convectional thunderstorms, during the six months from April to September inclusive, and 35 per cent during the other six months. This gives during the crop growing season an average of about 1¾ inches per month in the driest section and 2½ inches per month in the wettest.

The first killing frost usually comes the last of October or the first of November, and the date of the last killing frost in the spring is about the middle of April. But these have been known to vary at least a month in either direction, resulting in serious damage to crops.

In this high, dry, level country there is considerable wind throughout the year. March and April are the windiest months. Often during this time the deep blue of the cloudless sky is turned to white, to gray, to brown, by the approach of a howling sandstorm. These sometimes continue for two or three days at a time, causing much discomfort to human life and great damage to young growing crops. Hailstorms frequently occur locally throughout the region, usually in early summer; often these storms completely destroy growing crops and do much damage to buildings and livestock.

As far as averages go, the climate of this region, though not favorable in many respects, is not bad for agriculture. But in such a land where agricultural requirements are barely met by climatic averages, it is the abnormal condition that brings havoc to farm crops. And, too, since abnormally light precipitation is more likely to occur in regions of light rain, drought years are frequent throughout the province. Also abnormally late spring frosts or early fall frosts frequently cause great damage to crops.

It is with much difficulty that farmers and ranchmen have been able to cope with nature in a land without natural resources save its virgin soil, and cursed by an unfavorable climate of blasting blizzards and treacherous droughts. And slow has been their progress in the Llano Estacado. But by several decades of patient trials they have been able to give consid-

FIGURE 8.—The Cap Rock at Yellowhouse Canyon near Lubbock. The resistant capping layer produces a perpendicular escarpment which greatly hinders the approach to the region from the east. The lake in the foreground is fed by Buffalo Springs at the foot of the escarpment. (Courtesy of Lubbock Chamber of Commerce.)

erable diversion to this monotonous ranch country by slowly bringing large tracts of fertile soil under the plow. This region which only a few decades ago was the scene of typical western cattle ranching is now a land of many farms. Extending for miles unbroken, vast areas are dotted with fields of cotton, maize, and wheat. Every year fresh land is taken from the pasture and put under the plow. The cultivated area for the region as a whole almost doubled from 1925 to 1930, while in some counties the increase was as much as 500 per cent. Crops are becoming better acclimated and farmers are working out better methods year by year. More people are moving into the region. The population has more than doubled in the decade from 1920 to 1930 in practically every county of the region; and in some counties the increase was more than 1,000 per cent. The increasing value of land for the growing crops is pushing the ranch farther and farther west; and now the survival of the industry of former days is modern farming and stock raising.

THE COTTON BELT

In recent years in the southeastern part of the Llano Estacado, the keynote to agriculture is cotton. This broad expanse of fertile soil, once grazed by herds of longhorn cattle, is now the scene of numerous farms and fields in which cotton is the dominant crop. As a result of recent agricultural development, more than fifty per cent of the land in this region is now under cultivation (Fig. 9). Cotton is of outstanding importance here and dominates over all other agricultural crops. A number of counties have more than fifty per cent of the total cultivated land devoted to the one crop; while in the heart of the cotton belt of this region the acreage runs from 50 to 70 per cent.

Extending over large areas, these cotton farms are broken only occasionally by small fields of such feedstuffs as milo maize and other grain sorghums. Here the cotton farms are much larger than those of the Black Prairies to the east. The cotton acreage alone of a single

farmer here often is 100, 200, 500, and occasionally 3,000 or 4,000 acres in extent. Such farmers refer to their crops in terms of sections, halves, and quarters; and the large-scale method of cultivation is practically the only one followed. These

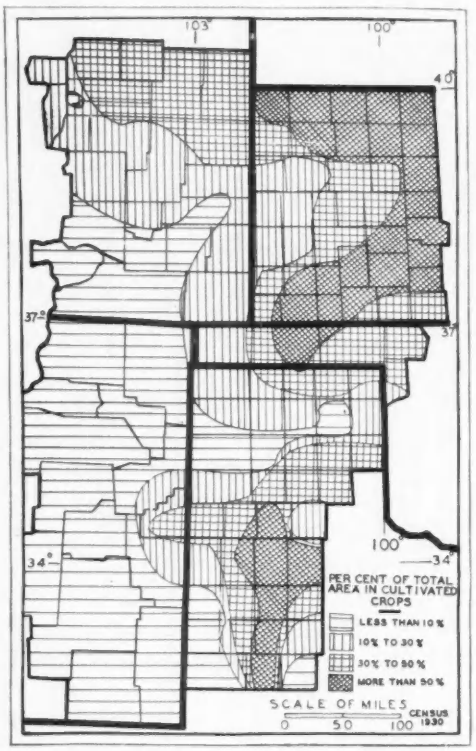

FIGURE 9.—Cotton constitutes the major crop where agriculture has invaded and occupied the grazing lands over which longhorn cattle roamed not so long since.

farmers, in fact, entire neighborhoods, depend on cotton; and if the crop fails for one or two years, such a community is almost panic-stricken. But when crops are good and prices are high, a general wave of prosperity sweeps the country. And three or four consecutive years are often sufficient to make many farmers independent.

Typical Cotton Farm Home

On a typical West Texas cotton farm there is much in its general appearance which suggests the extensive and extravagant system of farming which is employed throughout the area. Near the highway or country road which follows the section line, one may see the various buildings, stock lots, orchards, and garden patches which go with such a farmstead. Many residences are substantial, modern, frame buildings, new and apparently well kept; while on many farms the typical ranch house of a quarter-century ago is still in use. Many farm homes have modern conveniences, such as electric lights and other electrical appliances, running water, telephone, and radio (Fig. 10); and the family is never without an automobile, which is used both for business and for plesaure.

Somewhat removed from the residence are the barns, sheds, and lots. These though frequently small and poorly constructed, comprise an important part of the homestead; for on such large farms several teams of horses or mules, a number of milch cows, other cattle, and usually a few hogs, must be provided with feed and water and given some protection from the blizzards of winter. Medium-sized barns are used for storing maize, other grains, and some hay; but here where the rainfall is so light and the drying quality of the sunshine and the wind is so great, much hay and fodder is stacked in the open at places convenient for winter feeding. In the cattle pens, there is, as a rule, a separate shed and feedhouse where the farmer keeps cottonseed, cottonseed meal and hulls, and other such feed for milch cows. These buildings, together with a chicken house, smoke house, car shed, plow shed, and out house make up the buildings of such a farmstead.

One of the first essentials of such a

farm home, though not the most conspicuous, is a well of good water for both man and stock. Although the low rainfall and the great evaporation make this area dry and devoid of surface and running water, yet it is blessed with an abundant supply underneath the surface; and strong wells of pure, cool water, though sometimes slightly brakish or "gypy," can be had anywhere throughout the region by sinking boreholes to a shallow depth. Such a well, mounted by a large wooden windmill which is driven by the ever-present breeze, fills storage tank and watering troughs, besides furnishing irrigation water for a small vegetable garden and beds of flowers. There is some irrigation in all parts of the region; and in the vicinities of Hereford, Deaf Smith County, and Plainview, Hale County, several thousand acres of truck and general farm crops are irrigated from such wells by use of both wind and motor power.

FIGURE 10.—A well-kept South Plains farm home. Many of the homes here are new, substantial, and modernly equipped with electrical appliances, running water, etc. No country home is complete without a well and large wooden windmill. (Courtesy of the Lubbock Chamber of Commerce.)

A small pasture kept for work teams and milch cows may extend back from the barns and lots. This furnishes some grazing throughout the year, and saves quite a bit of the expense of feeding. On the larger farms often large tracts of grasslands are left for pasture; and herds of good-quality cattle are still kept in semi-ranch style. In the western border of this area the pasture acreage amounts to as much as forty to fifty per cent of the total; but usually it is less than this amount. Much of this pasture land is gradually being ploughed and fields of cotton and grain are taking its place.

In the garden which one finds on such a homestead usually only a few of such vegetables as cabbage, beans, and potatoes, are grown for fresh eating; and these products seldom go beyond the limits of the farm. A small orchard supplies the family with such fruit as peaches, plums, apples, and pears. But both garden and orchard are greatly damaged and retarded by the fierce spring winds; and on many farms they are not to be found at all.

In the rectangular field pattern which is carried out throughout most of this area (Fig. 7) often the entire section back of the farmstead is one large field. A comparatively small area of maize for grain and fodder is cultivated as feed for work stock and milch cows. On some farms a considerable acreage is given to wheat and oats; but usually fifty to seventy per cent of the cultivated land is in cotton.

Farming Characteristics in the Cotton Belt

Although cotton is the dominating crop over about half of the Llano Estacado, it is especially concentrated in the southeastern corner of this province just on top of the Cap Rock and along the eastern border farther north (Fig. 11). In the southern part where it is most concentrated, it occupies about 50 per cent of the

cultivated acreage; and in Lynn County, near the southern edge of the region, its area is 68 per cent of the total. The cotton belt here is a continuation of the great cotton district to the east of the escarpment. This cotton area extends from southeastern Texas into southwestern Oklahoma, including the transition zone, and overlaps into the eastern margin of the High Plains in the southeastern Panhandle section. But farther to the west in the western tier of Texas counties and in eastern New Mexico the rainfall of fifteen to eighteen inches per year is so low as to greatly decrease the acreage. North of Plainview, Hale County,

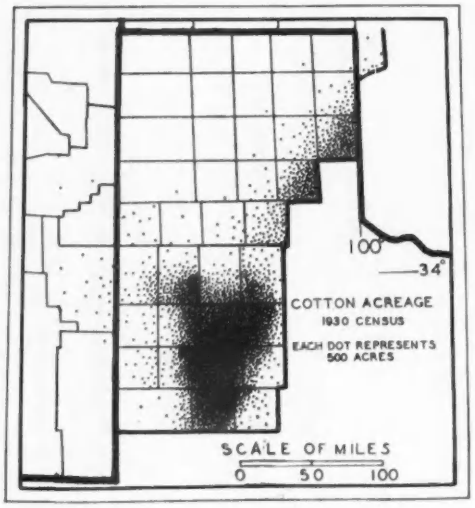

FIGURE 11.—Cotton cultivation is concentrated in the southeastern corner of the Llano Estacado just on top of the Cap Rock and along the eastern border farther north.

the cotton acreage decreases rapidly, except in the eastern border; and by the time the Canadian River is reached, cotton has disappeared almost altogether, giving way to wheat and maize. This condition is at least partly accounted for by the increased elevation, the slight shortening of the growing season, and the

FIGURE 12.—A South Plains field of cotton just beginning to open. (Field of broom-corn on the right.) Cotton on the High Plains does not produce a large, rank stalk, yet it yields as heavily as that of the Black Prairies to the southeast. (Courtesy of the Lubbock Chamber of Commerce.)

fact that cotton has moved into the region from the southeast, and has not yet penetrated very far to the northwest.

Six counties in this southern part of the Llano Estacado—Dawson, Lubbock, Crosby, Lynn, Terry, and Lamb—had over 100,000 acres each of cotton in 1929; Lubbock County leads with 205,276 acres, and a yield of 44,691 bales. Cotton acreage throughout this district is increasing year by year, but its increase has not been in keeping with the increase in cultivated area in the region in general. The ratio of cotton acreage to the total cultivated land was about ten per cent lower in 1929 than in 1924.

As stated above, only extensive farming methods can at the present time be successfully employed on the High Plains. In most of this area the scarcity of laborers makes it necessary to use large-scale methods; and a large per cent of the work is done by machinery. Many farmers use tractors for ploughing, listing, drilling, and harvesting, and the number of tractors has increased greatly in recent years; but the loose,

sandy nature of much of the soil prevents their efficient use throughout much of the region. Both mules and horses are used as draft animals in all parts of this southern area; and even where tractors are in use most of the cultivating and much of the plowing is done by horse and mule power. The farmers on most of the farms use large disc plows for breaking, and double-row planters and cultivators, and many of them own corn binders and grain binders for harvesting feed stuffs.

Often farmers do not plough cotton ground at all prior to planting. Sometimes between the first of May and the middle of June, after sufficient rains have fallen to sprout the seed and start the plants to growing, they list the land and plant the seed in the furrow. There is a distinct advantage in planting in a furrow, for it gives protection to the young plants from the strong spring winds which often blow as late as May and June, and sometimes even continue all summer. Little cultivation is needed for cotton here, on account of the light nature of the soil, the light rainfall, and the insignificance of weed growth. And here one man can cultivate as much land as two men can in the Black Prairie belt to the east.

Numerous efforts have been made to invent a machine for harvesting cotton; and although some have met with a degree of success, so far no invention has proven entirely satisfactory. Since so much labor is required for the harvesting of cotton, this is one of the outstanding problems confronting the farmer, not only on the High Plains but in other areas where cotton is grown. It is impossible to harvest an average crop with the same labor force required in the cultivation; and a great shortage of laborers occurs at the time of the picking season, which usually begins in October and continues through November or December. But the problem is usually met by employing transient people, or "cotton pickers" who drift into the region from the

FIGURE 13.—Close view of cotton plants after the frost has caused the leaves to fall off. Most of the High Plains cotton is picked after the first frost of autumn. (Courtesy of the Lubbock Chamber of Commerce.)

southeast. As the picking season in South and Central Texas opens from one to two months earlier than it does on the Plains, these laborers often work westward as the season advances, arriving on the Plains after the best cotton of the districts to the east has been picked over. Some Mexicans from near the border, and also a few East Texas Negroes may be seen here during the picking season. The dry fall and the absence of dews make the cotton of the Plains pick much more easily than that of Central and East Texas; and hundreds of people are attracted to this region each fall. Since the cotton crop here has become to a certain extent stabilized, farmers can depend upon ample laborers for the harvest season.

WHEAT

The northern part of the cotton belt just described merges into the winter wheat belt of the Great Plains. The transition zone separating these two great crops is one of considerable width, occupying the east-west tier of Texas counties just southwest of where the Red River cuts the one hundredth meridian to form the southwestern corner of Oklahoma. Throughout this zone the cotton and wheat acreage are near the same; but north of an east-west line through Plainview, Hale County, there is a steady decrease in the cotton acreage, except along the eastern margin of the region, and wheat is the dominant crop. Nowhere in the Llano Estacado, however, does wheat attain the importance reached farther north in southern and central Kansas. The fact that a much higher percentage of the Kansas area is under cultivation (Fig. 9) helps to explain the greater significance of wheat there.

The level, fertile loam soil of this region is well adapted to wheat growing; and the 15 to 23 inches of rainfall, coming chiefly from April to September, favors wheat production throughout the area. But these same soil and climatic conditions

FIGURE 14.—Cotton bales left in the open awaiting marketing. This farm home is not well kept, and is below the average in general appearance. (Courtesy of the Lubbock Chamber of Commerce.)

meet the requirements of such crops as sorghums and cotton; and in places these have proved more profitable crops than wheat. But in spite of this competition, wheat is gaining in importance in every county of the Llano Estacado. In 1924 it occupied 22 per cent of the total cultivated land, while in 1929 this ratio had increased to 37 per cent. And for the region as a whole wheat has by a considerable margin the greatest acreage of any crop.

Although the Llano Estacado does not have all the marks of a typical permanent wheat country, in spite of competition with other crops it will doubtless continue to produce a great deal of wheat. Here the smoothness of the topography and the cheapness of the land favor large-scale wheat growing (Fig. 15). Fresh, new land is being sown each year, and in places both acreage and yield are increasing. The methods that are used here are much like those which are followed farther north in Kansas and in Oklahoma.

FIGURE 15.—Harvesting wheat on the South Plains. Large land holdings and level relief favor the use of the largest of farm machinery. The combine is the most efficient harvester for the large-scale wheat grower, and many farmers are using it throughout the South Plains. (Courtesy of the Lubbock Chamber of Commerce.)

FEED CROPS

The outstanding feed crops of this region, both for grain and for fodder, are the grain sorghums. Throughout most of the area the rainfall of fifteen to twenty inches is sufficient to ensure a good crop the average year; and even in drought years the crop is not often a complete failure. These are much the surest crops for this area of uncertain rainfall; and consequently farmers depend upon them a great deal for feed (Fig. 16). Milo maize leads this group of crops, yielding heavily throughout the area; and kaffir corn, higeira, feterita, and sorghum canes total high in the cultivated acreage.

Much of the sorghum of this region is headed by hand and either threshed or fed in the head; but in recent years farmers are using the grain combine to a great extent, thereby greatly reducing the expense of harvesting. A great deal of the crop is cut with corn binders, and threshed or fed as fodder. The latter is especially the case in extreme western Texas and in New Mexico. Here the rainfall is not sufficient to ensure a good crop of grain; but enough of the grain matures to strengthen the fodder, making good feed for horses, mules, and cattle.

There is no area of special concentration of the sorghum crops, and they are found fairly well distributed over most of the Llano Estacado. As the rainfall here is too light to ensure good yields of corn and oats, the sorghums are practically the only feed crop that can be depended upon. The importance of this family of crops can hardly be overestimated; and the dependence placed in them in this area is great.

Timothy, sudan, and various other tame grasses grow over much of this area; while wild prairie grass forms the most important single-hay crop throughout the western part. A little alfalfa is raised in many sections, but the climate is so dry that it does not do especially well; and so far its acreage is insignificant. Throughout the drier western part of the region beans and cow peas are of some importance; but their production here is of minor significance when compared with that of the area to the west.

Oats and corn which are quite important crops in the region to the north, are grown to some extent throughout the Llano Estacado; but in most parts it is too dry to ensure good yields. Corn acreage is gaining some in importance especially toward the western margin of the region. Some years it produces a good yield; but it is quite unlikely that it will

FIGURE 16.—A field of grain sorghum on the South Plains. No other crop is as certain in a region of light rainfall. Farmers depend upon the sorghums for feed for cattle, hogs, and work teams; many of them grow large quantities for sale. (Courtesy of the Lubbock Chamber of Commerce.)

ever compete successfully with cotton, wheat, and sorghums.

LIVESTOCK

Although large-scale cattle ranching no longer prevails on the Llano Estacado, yet the region still produces a great number of cattle. Even in the southeastern portion of the area where from fifty to seventy per cent of the farm land is cultivated there is sufficient pasture land left to support considerable numbers. But throughout much of the region cattle raising is carried on in connection with farming; and in recent years on many of the stock farms, farmers feed a considerable number of cattle each year (Fig. 6).

Cattle are somewhat equally distributed, not only in the Llano Estacado but over the Southern High Plains in general, and there is no area of special concentration. Although the lighter rainfall of the western section causes that area to have a much lower cattle-carrying capacity than the part farther east, yet the cultivated area throughout the west is small and the pasture land relatively high, thus keeping the cattle density about equal from east to west.

In recent years there is a tendency toward a higher grade of cattle throughout this area. Improved breeds including Herefords, Durhams, and other beef breeds have almost supplanted the Texas longhorn. These better breeds receive much more care and attention than the former ranch cattle received; and cattle values are much greater per unit area than was the case in former years. Throughout the region the ranches and pastures are much smaller than formerly. The wire fence has to a great extent eliminated the range rider; and the nature of the cattleman's work has been greatly

changed. The fencing of pastures has made possible careful breeding, grading, and feeding, thus meeting the demands for high-grade stock throughout the region.

Modern meat packing plants at Amarillo and Lubbock handle much of the beef, mutton, and pork produced in the region. These are proving a great asset to the livestock industry, eliminating the high freight costs to the Fort Worth and Kansas City markets.

Most of the horses and mules raised in this area are used on the farms and ranches, there being relatively few sold outside the region. Horses outnumber mules only slightly in the eastern part where farming is most important; but farther west where the cattle industry dominates, mules are much less numerous than horses. Mules have proved somewhat superior to horses for work animals on the farms; but since the wide use of the tractor, both are of less importance now than formerly.

The relatively high land value is prohibitive to economical sheep and goat raising in the Llano Estacado; and they are insignificant throughout the area. Only scattering bunches occur here and there, and little interest is shown in raising them either for meat or for wool. Hogs are increasing somewhat in numbers; but the two cash crops, cotton and wheat, are occupying much of the cultivated area, and little hog feed is produced. The prestige of the early cattle ranch continues to be strongly felt throughout the High Plains; and it is not probable that other livestock will ever rival cattle in this region.

THE BANANA IN CARIBBEAN TRADE[1]

Jesse T. Palmer

THE extent to which the development of the banana trade between the United States and the countries of the Caribbean has been a factor in the economic and political development of the Caribbean countries forces a consideration of the major problems awaiting solution. They are dealt with under the following heads: (1) the historical and statistical development of the banana trade between the United States and the countries of the Caribbean, (2) the production of bananas, (3) the distribution of bananas, and (4) the place of the banana trade in the commercial development of the Caribbean countries.

Historical and Statistical Development

The banana originated in southern Asia, has traveled east and west, completely encircling the globe, and is now cultivated throughout the tropical and subtropical regions of the world (see Fig. 1). There are three banana belts or zones running around the world longitudinally from east to west: the two outer or subtropical belts, where the smaller, dwarf varieties, more resistant to cold and drought are extensively grown, and the inner tropical belt where the taller, larger varieties are grown.

The banana and its relative, the plantain, which is a big coarse-cooking banana, not palatable if eaten raw, are the chief food and subsistence crop of the peoples of tropical lands, and are of basic importance in tropical alimentation.

In the year 1516, Rev. Father Tomás de Berlanga, a Spanish priest, carried some banana roots to Santo Domingo, an island of the West Indies. In 1804, 30 bunches of bananas grown in Cuba were received at New York, and in 1830 there were 1,500 bunches. By the end of the year 1857 a regular trade was developed between southeastern Cuba and Boston. In 1869 an additional supply was secured at Port Antonio, Jamaica.

The banana trade began in earnest in the year 1866, when Carl August Franc, a ship's steward, brought a small quantity of bananas of the yellow variety from Aspinwall, Colombia (now Panama) to New York. Imports of bananas into the United States, valued at $214,343 in 1867, gradually increased in value until 1874, when imports fell to $92,318, due to the panic of 1873. The following table shows the value of imports of bananas into the United States from 1867 to 1874.

United States Imports of Bananas
1867–1874

1867	$214,343
1868	125,496
1869	132,629
1870	185,596
1871	229,924
1872	395,585
1873	375,352
1874	92,318

The number of bunches of bananas imported for this period was not recorded.

[1] An abstract of the thesis submitted to the Graduate School of the University of Illinois in partial fulfillment of the requirements for the degree of Master of Science in Economics, August, 1931.

Shipments of Aspinwall bananas practically ceased in 1881, due to competition from the French for labor in building the Panama Canal.

Captain Lorenzo Dow Baker first successfully transported bananas from Jamaica to Boston in 1870. In 1871, Minor C. Keith began railroading in Costa Rica and obtained a supply of banana roots from France at Aspinwall with which to establish

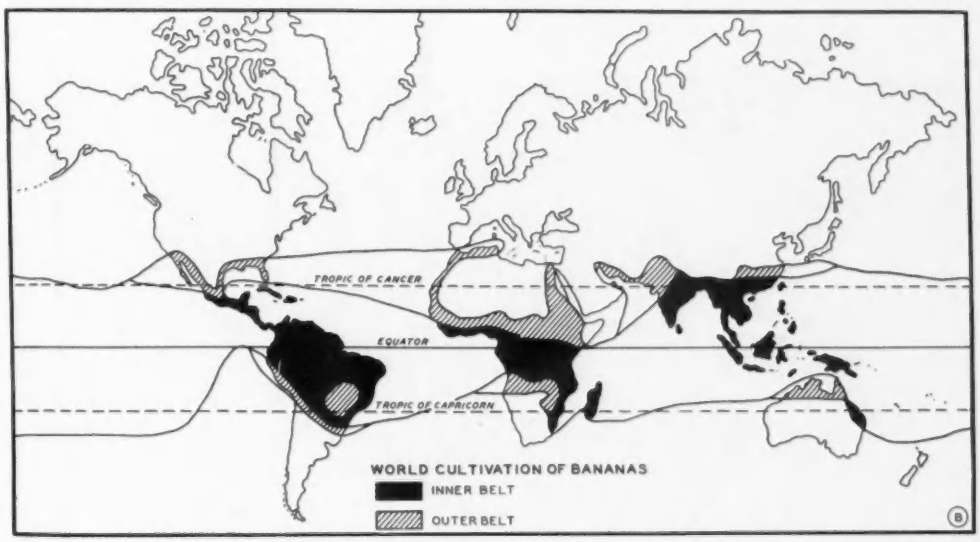

FIGURE 1.—The belt of distribution of banana culture extends quite through the tropics from north to south and around the whole world. (From Rushman's "Banane," p. 15, after Rung "Verbreitung der Bananenkultur.")

plantations to furnish freight to his railroad. He made a trial shipment of 250 bunches to New Orleans in 1872 and thus firmly established in that city the business of banana importing. In 1879 he shipped Costa Rican bananas to New York by steamer, and in 1882 made his first shipments from Bluefields, Nicaragua, to New Orleans.

By 1879, Captain Baker had established an organization in Jamaica through which he made shipments to New York by the Atlas Line.

Banana imports increased gradually from 1875 to 1881. Then there was a sudden increase as will be seen from the following table, due to the short fruit crop in the United States in that year.

Banana imports increased rapidly from 1882 until the turn of the century, the replacement of schooners by steamships for carrying bananas in the eighties being an important factor.

Until 1885 no systematic attempt had been made to develop production and transportation of this fruit. Starting as a shipping enterprise, it was found necessary to establish plantations to insure full regular

UNITED STATES IMPORTS OF BANANAS
1875–1901

Year	*Value*	*Year*	*Value*
1875	$487,674	1889	$3,578,325
1876	502,452	1890	4,653,779
1877	416,733	1891	5,854,758
1878	539,534	1892	5,000,632
1879	510,639	1893	5,361,187
1880	682,755	1894	5,122,503
1881	640,081	1895	4,674,861
1882	1,171,770	1896	4,502,746
1883	1,331,998	1897	4,086,320
1884	1,832,013	1898	4,236,418
1885	2,146,113	1899	5,665,588
1886	2,357,662	1900	5,877,835
1887	2,729,477	1901	6,550,186
1888	3,157,988		

cargoes, and in turn to create a steady demand at a fixed price for the then tropical luxury.

In 1884, Andrew W. Preston of Boston, who had been selling consignments of bananas from Captain Baker of Jamaica, induced nine men to join him in an organization to promote the banana business with Boston as the port of entry. Thus was formed the Boston Fruit Company in 1885, marking the birth of the modern banana business.

FIGURE 2.—Crates of bananas in transport by camel on the Canary Isles. (Courtesy of United Fruit Co.)

W. W. Hurlbut and Company chartered the first steamship (Atlas Line) ever chartered for the West Indian banana trade in 1879.

The Boston Fruit Company produced its bananas in the West Indies. The Fruit Dispatch Company, incorporated by Preston in December, 1898, sold the fruit of the Boston Fruit Company in the United States. Keith, another important planter, produced his fruit in Central America and imported mainly through New Orleans.

Up to 1900, most of the companies had been inadequately financed and under the management of men who had no practical knowledge of the banana industry. Few companies had had their own banana plantations, and most of them had only one source of supply and one port of entry into the United States. It was evident to the leaders of the banana trade that: (1) consolidation of interests was necessary in order to bring under one control large producing areas; (2) new territories had to be opened up in the tropical jungle and sanitation and preventative medicine employed in the making of extensive banana farms; (3) the interior markets in the United States had to be developed and a regular demand for bananas throughout the year created, and (4) ocean transportation and refrigeration had to be perfected. The big problem in the banana industry has always been to produce more bananas for a steadily mounting popular demand. The pioneers in the banana trade had proved two things: first, the people of the United States liked bananas and would eat them in very large quantities if offered at prices which would compete with such home-grown fruits as apples, peaches, pears, and oranges; and, second, bananas could be grown

cheaply and in large quantities in certain tropical sections. Flood, drought, and high wind were the most serious elements to be contended with in the banana industry; large capital and a highly efficient organization was necessary to overcome them.

There were engaged in the banana trade in 1899, in addition to the Boston Fruit Company and the interests of Minor C. Keith, no less than 114 other companies importing bananas. On the eve of the new century, there had been many consolidations of banana importing companies, but none of them were of a permanent nature.

In 1898, the firm of Hoadley and Company, consignees for bananas produced by Keith failed, thereby forcing him to seek a new outlet for his fruit. Satisfactory arrangements were made with Preston, and from the new business contact sprung the United Fruit Company, incorporated on March 30, 1899, with Preston as president, and Keith as vice-president. Thus were united the plantations of the Boston Fruit Company (originating as a shipping enterprise) located in the West Indies (see Fig. 4) and marketing its fruit in the northeastern market area, and the Keith interests (originating as a railroad enterprise) in Central America and Colombia and marketing its fruit in the Mississippi Valley market area.

In the eighties, schooners carrying cargoes of 10,000 stems of bananas gave way to steamers carrying double and triple that number. The earliest steamers were ventilated by means of ventilators with wind sails. Today

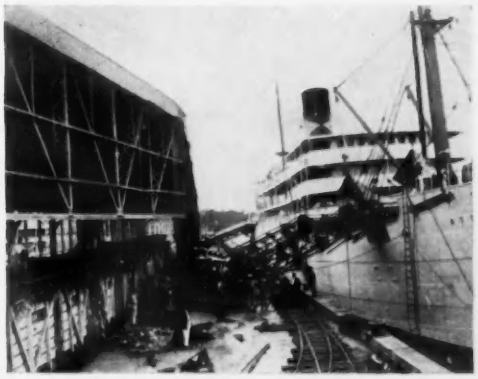

FIGURE 3.—The banana trade has developed a technique and equipment that is almost the last word in scientific progress and achievement. Whole batteries of banana loading machines of the very latest type are used in connection with the great refrigerating ships. (Courtesy of United Fruit Co.)

banana steamers are of two types: naturally ventilated type and refrigerator type. In naturally ventilated steamers, large intake cowls or ventilators on deck are adjusted to the direction of the wind, and likewise outlet cowls to exhaust the vitiated air. Refrigerator banana ships now use powerful refrigerating machinery and carbon dioxide gas, and, of course, use a forced circula-

UNITED STATES IMPORTS OF BANANAS
1902–1930

Year	*Bunches*	*Value*	*Year*	*Bunches*	*Value*
1902	29,229,748	$7,307,437	1917	34,661,179	$12,724,198
1903	33,164,624	8,541,156	1918	34,549,913	15,147,643
1904	30,839,904	7,709,976	1919	36,993,095	15,934,596
1905	38,093,803	9,897,821	1920	39,320,000	19,088,000
1906	35,103,279	10,330,302	1921	43,366,000	19,385,000
1907	37,436,579	11,883,167	1922	45,093,892	19,145,911
1908	37,003,388	11,391,211	1923	43,958,890	19,738,508
1909	36,973,584	11,012,100	1924	47,384,017	22,074,410
1910	38,156,659	11,642,693	1925	55,483,374	29,692,912
1911	44,699,222	14,375,075	1926	56,251,083	31,684,306
1912	44,520,539	14,368,330	1927	61,009,425	34,269,450
1913	42,357,109	14,848,258	1928	64,307,656	35,381,271
1914	48,683,592	16,397,884	1929	65,134,106	36,048,000
1915	41,091,585	13,512,960	1930	62,730,827	34,794,184
1916	36,754,704	12,106,158			

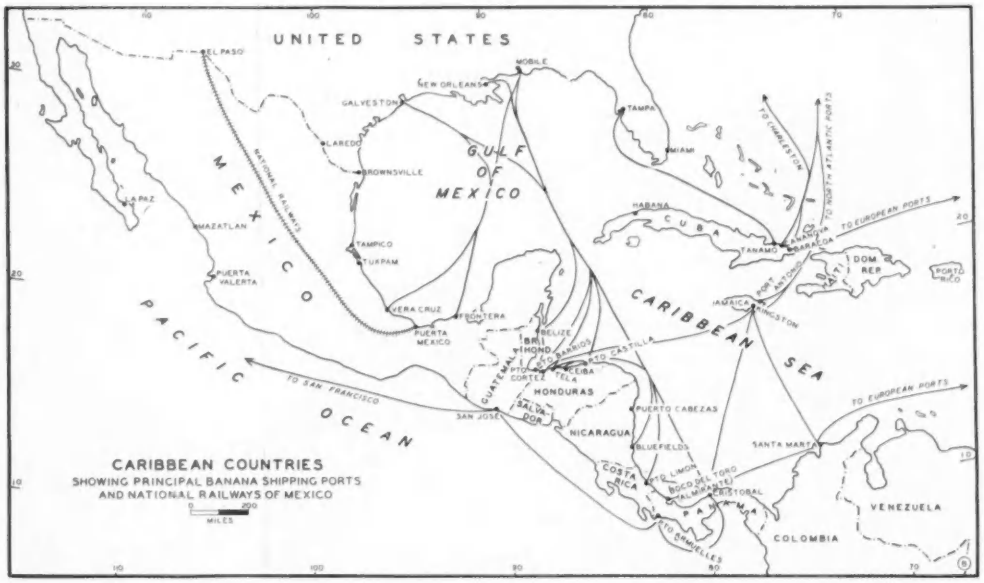

FIGURE 4.—The principal banana shipping ports of American producing areas are almost all on the coast of the Caribbean, accessible to the great centers of population on the North Atlantic basin. (Taken from map by the United Fruit Co.)

tion of air. Experiments were begun with refrigeration in 1901 and were perfected in 1904. The banana importing business spread to England and the Continent at this time, and steamship and radio service were perfected serving the general public as well as the banana industry.

There was a rapid increase in banana imports from 1902 to 1914, when the trade was seriously deranged by the World War, as will be seen by the table on the preceding page.

The per bunch invoice value increased from 25 cents in 1905 to 35 cents in 1913, then declined to 33 cents in 1914 and to 32 cents in 1915, rising to 56 cents in 1926. Since 1911, the value of bananas imported reached its lowest point in 1916, and the quantity imported (bunches) reached the bottom in 1918. From 1918 on, the quantity of bananas imported has rapidly increased until the peak year of 1929 when the quantity imported reached 65 million bunches valued at 36 million dollars. The year 1930 is remarkable inasmuch as it was the first year in the history of the banana trade when the supply of bananas was adequate to meet the demand, largely due to the new plantations just coming into production. Unfortunately, due to the widespread business depression, imports of bananas into the United States dropped to less than 63 million bunches valued at about 35 million dollars. While the figures for 1931 are not yet available, imports are known to have declined sharply due to a decrease in consumption. Bananas accounted for 3.4 per cent of the total imports of the United States in 1913–1914, and 3.3 per cent in 1929. In 1928, bananas constituted 53 per cent of our total imports from Central America.

The period from 1899 to 1914 was important in the establishment and organization of the banana industry,

in assuring its permanency, and in diversification and expansion of the sources and areas of supply, and in the sources of income to the fruit companies. The period from 1914 to 1930, however, was even more important to the fruit companies. Competition was keener. The losses from devastating floods, droughts, "blow-downs," and disease, were reduced by irrigation, by developing numerous sources of supply in widely separated localities, by research and

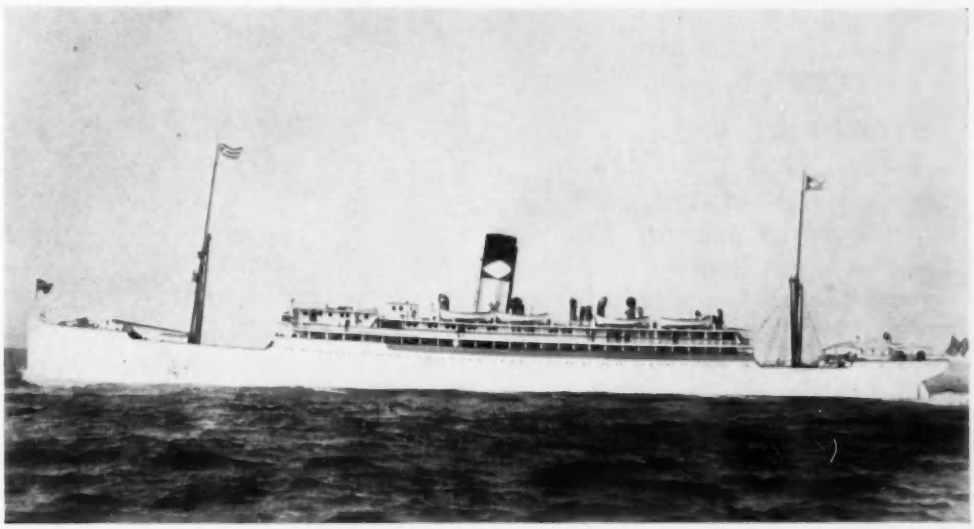

FIGURE 5.—No finer transport bottoms have been built than the speedy, comfortable, efficient refrigerating banana ships that cruise the "seven seas" of the world with their valuable cargoes of palatable, nourishing fruit. (Courtesy of United Fruit Co.)

experimentation, and by improved transportation facilities and organization. That the banana trade had been highly remunerative to the fruit companies was amply proved by the long list of companies that had been organized; that many were not long successful from the lack of capital, poor management, or competition was shown by the long list of reorganizations and consolidations.

From building especially constructed refrigerator ships for carrying bananas, the fruit companies have become the most important common carriers in the Gulf and the Carribbean, carrying general freight to the tropics, thereby assuring the greatest possible economy and paying value. In addition to producing and transporting bananas, the fruit companies grow and manufacture sugar, and raise coffee, pineapples, and citrus fruits; they have been awarded valuable mail contracts in connection with their businesses as common carriers; they own and operate railroads, telegraph and radio stations, hotels, banks, mercantile establishments, hospitals (serving a large public as well as their own employees), electric light plants, and engage in many other activities intimately connected with the peace and prosperity of the countries of the Caribbean.

Most of the banana ships are of the refrigerator type. Their speed averages about 14 knots per hour, and the sea trip varies from 4 to 7 days—longer on the Pacific run—15 to 17 days to England and the Continent.

The banana ships carry from 25,000 to 60,000 stems of bananas, and occasionally carry as many as 80,000.

There is no import duty on bananas entering the United States. Most of the Caribbean countries levy 1 to 2 cents per stem export duty for fiscal revenue.

The shifting of the banana industry from the Islands of the West Indies to the mainland of Central America occurred noticeably between 1900 and 1915. Recently the production of bananas has been shifting to the Pacific Coast of Central America, where production and marketing conditions are not so favorable.

PRODUCTION OF BANANAS

The banana industry depends on three factors: (1) suitable banana land, (2) the banana plant, and (3) capital and organization.

The banana is a tropical plant growing best where there is an abundance of rain, heat and sunshine, and a deep fertile soil. They thrive best at or near sea level. The plant grows rapidly, and matures early, producing an enormous amount of food in proportion to the area occupied. Each banana tree yields but a single bunch of fruit in 12 to 16 months, and after harvest the tree is cut down. However, the old root sends up many "suckers" at different intervals to take its place, each eventually maturing and bearing its bunch of fruit.

The development of a modern banana plantation requires the highest degree of organization. A temporary base of operations is selected, and an experienced personnel clears the jungle. Since the banana takes about one year from planting to harvest, it is necessary to clear and plant a large area in the quickest possible time. Drainage around camps and of farms is a primary act of sanitation and a necessary prerequisite of banana culture. Development of farms and construction of living quarters and offices, hospitals, railroads, and docks are carefully coördinated.

The harvest is the final object of all activity. By means of production estimates and cutting advices dispatched by telephone and radio, production is closely geared to consumption, thus avoiding considerable loss. Fruit cutting or harvest is an important day on the banana farm. Plans and careful preparations are made the day before. The mature fruits (they are always harvested while green) are cut from the tree, carried to the nearest railroad, loaded into cars and hauled to port where they are loaded on the ship, every precaution being taken to protect the hard green fruit from bruises during its long journey.

FIGURE 6.—Preparing and planting a banana plantation. When surveyed the land for the plantation is laid out in tracts convenient for the assignment of labor, and suitable records of cost of operation and production. (Courtesy of United Fruit Co.)

It is difficult to determine the capital investments in the banana

FIGURE 7.—The better to control the supply of water the plants must have, ditches for irrigation and drainage both must be dug and carefully kept free from the rank tropical vegetation. (Courtesy of United Fruit Co.)

trade. On the basis of the investments of two companies, and the number of smaller concerns engaged in the banana trade, it seems reasonable to conclude that at least $300,000,000 worth of capital is invested in the banana trade. The banana trade is an extremely risky business, partly because the banana is a highly perishable food, and because of the elements of destruction to which it is subject on the plantation. Only an adequate supply of capital and efficient organization can cope with these forces. On the whole, the banana industry is highly remunerative under auspicious conditions, but the net earnings of a fruit company fluctuate widely from year to year.

DISTRIBUTION OF BANANAS

The holds of banana ships are heavily insulated. The banana gives off large quantities of carbon dioxide gas, and large amounts of heat, and absorbs oxygen. For these reasons pure, cooled, dry air is circulated through the holds, and the used humid air is drawn out, by means of fans. Bananas are carried at a constant temperature of 57° F. The time of the arrival of the ship is radioed ahead to the port of entry, and men, unloading machines, and railway cars are ready to receive the fruit. The entire cargo is discharged in 8 to 12 hours. The bunches are stowed in cars which have been papered and strawed, iced, and "light-weighed" in preparation for the loading and the long trip inland. To insure impartial inspection and weighing, to buyers in the interior and the fruit companies, this service is maintained by chambers of commerce. Refrigerator cars are owned by equipment holding companies, and are leased to railroads for hauling bananas and other fruits. They are iced in summer, and may be heated in winter.

The minimum and maximum loadings are 20,000 and 23,000 pounds, respectively.

There is little shrinkage of bananas in refrigerator ships. Those carried in ventilated, non-refrigerator ships shrink ¾ to 1 pound per bunch per day. It is believed that bananas shrink 2½ to 3 per cent in railroad transit.

weight for 9's (nine-hand bunches). All bananas are now sold wholesale by weight. Most retailers now sell by weight, only a few offering bananas by the dozen.

When the green bunch of bananas reaches its destination, it is placed in a special ripening room, with heavily insulated walls, where the proper temperature and humidity is maintained until the bunch is ready to go to the retail dealer.

FIGURE 8.—Proper ripening is an important stage in the process of preparing the banana for the market and the table; specially constructed rooms with carefully controlled temperature and humidity. (Courtesy of United Fruit Co.)

When bananas enter the ports of the United States, they are turned over to the selling subsidiaries. The selling companies have representatives located in the principal cities who take orders for bananas in carlots. These orders are consolidated and telegraphed to seaboard in code. A system of forecasting future sales of bananas which has meant a great deal to the banana trade is in operation. Bananas are sold at a certain rate per 100 pounds for bunches of a certain class, *e.g.*, $3.20 per hundred

The following qualities of the banana have in no small measure been responsible for the great demand for this all food-fruit in this country: (1) it is a very important source of energy, vitamins, and mineral salts, (2) its cost is low in terms of food value compared with other foods, (3) it can be shipped long distances under proper conditions without deterioration, (4) it reaches the consumer in a natural germ-proof package, and

(5) it is an all year food-fruit obtainable in abundance at all seasons of the year, especially in the winter when fresh fruits and green vegetables are scarce and expensive.

RÔLE OF THE BANANA TRADE IN COMMERCIAL DEVELOPMENT OF THE CARIBBEAN COUNTRIES

The opening of the nineteenth century was the dawn of a new era for the countries of the Caribbean. Until that time, these countries had been sparsely populated, and the lowlands had been unoccupied except by poison snakes, ferocious animals, myriads of insects, and dreaded diseases. Men shunned the dark tangled forests of the swampy lowlands and lived on the plateaus. There was little industry as the land was frequently torn with revolution. The scene was changing. On the eve of the birth of the present century there was launched in Boston what has become one of the most significant enterprises the world has known —the modern banana industry. Now staunch New Englanders are putting their money into the proved business of banana production and distribution. American engineers are invading the jungles with steam shovels. Swamps are being drained and axes are heard ringing in the woodland. Fruitful banana plantations are appearing as if by magic.

The Caribbean lowlands, as they appear today, are a place of prosperity as one-quarter million acres of the most fertile lands have been reclaimed for the use of man, and its sanitation completed. This area is served by 2,000 miles of railroad, and is connected with all parts of the world by radio, telegraph, and telephone. One hundred and fifty modern refrigerator steamships now carry passengers, mail, and general cargo to the tropical banana ports of the Caribbean, and bananas to the United States and Europe. One hundred thousand nationals of the Caribbean countries benefit directly from the banana industry. Contrast these prosperous banana communities with the almost poverty-stricken countries of the past. The annual payrolls amounted to 50,000,000 in 1930, including payments for fruit grown on contract by nationals. Modern hospitals and field dispensaries are serving 200,000 employees and nationals.

Central America, because of this improved economic, and subsequently more stable, political condition, due largely to the development of the banana industry, has become one of the best markets for goods manufactured in the United States. Central America now buys large quantities of flour, cotton goods and clothing, shoes, leather goods, case oil, dairy products, vegetables, eggs, meat products, radios, musical instruments, moving pictures, paints, washing machines, automobiles, pumps, electrical goods, iron and steel products, and many other articles from the United States.

The United States exports to the Caribbean foodstuffs not grown there, such as fruits, vegetables, and cereal grains of the temperate climate, and manufactured articles.

Imports into the United States of products from the Caribbean area have increased as have exports to the same region, as shown by the table. The United States imports in large quantities cocoa, chicle, sugar, hides and skins, henequin fibre or sisal, Spanish cedar, molasses, vegetable ivory, balata (gutta percha), coconuts, coffee, pineapples, gold, silver, platinum, pearls, and bananas,

FIGURE 9.—The banana warehouse in the outskirts of Paris affords opportunity for expeditious delivery of the fruit to the public. Throughout Europe the consumption of bananas is fast increasing, from Norway to Greece, from Ireland to Finland. (Courtesy of United Fruit Co.)

In general, the countries of the Caribbean import manufactured goods, and export agricultural products, which pay for the imports. Because of its proximity, the United States is the largest participant in this important trade.

The Caribbean countries also import capital, largely from the United States, for the construction of highways, railroads, needed public projects, electric light and water systems, and for the development of plantations.

The nationals of the Caribbean, in the neighborhood of the banana plantations, are as familiar with the currency of the United States as they are with their own currency. When the interior of the banana countries is visited, the prosperity of the plantation workers is keenly appreciated.

The banana trade has been a very important factor in the peace of the Caribbean. Men who would otherwise be willing recruits for an insurrection leader have elected to enjoy the fruits of peace and prosperity to be had by working on the banana farms. While the banana trade has suffered from the recent world-wide business depression, the banana farms generally provide steady year-round employment. Along with the development of the banana trade and its various relationships has come a friendlier feeling toward the United States.

UNITED STATES TRADE WITH THE CARIBBEAN
(In Thousands of Dollars)

Country of Destination	*Exports* 1913	1929	*Country of Origin*	*Imports* 1913	1929
Mexico	48,052	133,863	Mexico	81,735	117,738
British Honduras	1,527	1,893	British Honduras	1,789	3,336
Costa Rica	3,517	8,313	Costa Rica	3,458	5,203
Guatemala	3,367	11,525	Guatemala	3,414	8,470
Honduras	3,753	12,811	Honduras	3,314	12,833
Nicaragua	2,888	7,031	Nicaragua	1,669	5,748
Panama	24,368	41,133	Panama	4,665	5,351
Salvador	2,271	8,050	Salvador	1,470	3,830
British West Indies	14,439	27,257	British West Indies	14,211	22,022
Cuba	73,239	128,908	Cuba	125,094	207,421
Colombia	7,647	48,983	Colombia	15,714	103,525

SUMMARY

The banana trade developed in two parts of the Caribbean region independently and at the same time. The consolidation of these two interests in 1899 gave birth to the present banana industry. As a result of the solution of the main problems involved in the organization and development of the banana trade, there has developed in the banana producing and exporting countries the most important fruit farms of the world—all within a very short period of years. This has meant the populating of a vast area formerly uninhabited. Not only has the banana become an

important source of livelihood for many people, but the banana trade has vastly increased the purchasing power of the Caribbean Republics, and, in turn, created expanding markets for manufactured articles especially from the United States. The banana industry has contributed considerably to the solution of the ever-pressing problem of the nation's food supply in both America and Europe and has given to the markets of the temperate zone, at all seasons of the year, an inexpensive and nutritious food-fruit, quite different in character and flavor from any of the fruits of the cooler climates.

Until recently the banana was a domestic commodity, in fact it is still the chief subsistence crop in the tropics, but refrigerator ships have made it an object of international trade. Success in the banana trade has depended largely on a high degree of business organization, and, in turn, on a thorough system of radio and telephone communication. The financial requirements of the banana industry are very heavy, since whole plantations frequently have to be rehabilitated as a result of flood or hurricane. The fact that the fruit companies' own business moves from the tropics to the United States makes available on the return trip a large amount of space for goods exported by merchants of the United States to the various countries served by their steamship lines. The fruit companies do a large mercantile business in the Caribbean.

The banana trade is not only highly organized for production in the tropics, but the same efficient organization is carried on in the distribution of the fruit in the United States. Speed in loading and discharging cargoes, and cheapness of operation is obtained by using specially perfected machinery. Whole trainloads of bananas are dispatched inland, under the protection of banana messengers who keep careful watch of the temperature in the banana cars. The fruit companies maintain a dealers' service, their concern for the banana ending only when the consumer gets a good banana, thoroughly ripe, and at a low price.

The banana trade has been an important source of peace, good will, and friendship between the United States and the republics of the Caribbean.

IRON AND STEEL INDUSTRY OF WHEELING, WEST VIRGINIA

Langdon White

WHEELING, like Pittsburgh and Youngstown, is universally looked upon as a "steel city." It is a part of the Middle District (Fig. 1), which literally throbs with industry and is the greatest iron and steel region in the world. The Middle District has about 50 per cent of the steel ingot capacity of the United States and consumes a very considerable portion of it in secondary manufacturing enterprises. Despite enormous consumption, however, it necessarily disposes of tremendous tonnages outside its natural trade territory. So long as the Pittsburgh Plus[1] system of basing prices was in vogue, the Middle District had little difficulty in disposing of its surplus steel, but in 1924 this practice was abolished by the Federal Trade Commission. Since then the entire region has lost ground.

In this paper the Wheeling, West Virginia, segment of the Middle District will be analyzed and an effort made to determine its future status. Is it destined to lose ground as have the similarly located Ashland and Ironton or will it continue as a great metallurgical center?

Birth of Metallurgy in Wheeling

Wheeling began as a frontier settlement in 1769, but it had no iron mill until 1832, when its first iron master came down from Pittsburgh. For this industry the city possessed two noteworthy advantages—a copious supply of coal and good transportation facilities. It was considered by many, the *reliable* head of navigation on the Ohio, inasmuch as shallows and other impediments lay between it and Pittsburgh. Moreover, the National Road crossed the Ohio at Wheeling and cities of importance invariably spring up where important routes of travel cross.

Wheeling offered no inducements for blast furnace construction at an early date, since the few known deposits of ore were scattered and lean, and since charcoal was used for smelting and the tributary area had been largely cleared of timber. But the important local fuel supply favored puddling and finishing, and the river afforded a splendid highway for receiving Pittsburgh pig iron and for dispatching finished products to western marts. From the very beginning, Wheeling specialized on the "aristocratic" forms of iron—those responding to advantages like skilled labor and superior marketing facilities. Such products as rails, structural shapes, and the like never prospered, because raw materials were not located nearby (Fig. 2).

The Nail City

Because wooden buildings were the rule in the 19th century, nails were in great demand. As the incipient civilization spread over the

[1] If a Detroit buyer purchased steel from a Cleveland mill, he paid the price f.o.b. Pittsburgh and in addition the freight rate (the "Plus") that would have been assessed against shipment from a Pittsburgh mill.

great potential farm lands of the Middle West and homes sprang up like mushrooms, Wheeling, combining its strategic transport and market location with the three latest developments in iron-making—puddling, rolling, and mechanical nail-cutting—became the nail capital of the world. Its reputation for nails spread far and wide: "On a keg of nails, 'Wheeling' stood for as much as 'Sterling' on a silver spoon."

The first mill was located on the river bank at the northern end of the town. Locally mined coal and Pittsburgh and Missouri pig iron were used.

About 1850 the reign of coke began. With charcoal out of the picture, Wheeling became a smelting center. The first blast furnace was erected in the district in 1857—on a hillside above Martin's Ferry, just across the river from Wheeling. It was first fired with coal, but later with coke. Ore and limestone were hauled in wagons some three miles, Connellsville coke was freighted down the Ohio, and water was drawn from a nearby swamp, except during dry weather, when it was hauled from the river in tank carts. This furnace had a daily output of only 10 tons, but it was the initial step in making the district self-contained. Wheeling, of course, never succeeded in making pig iron so cheaply as some localities, for the raw materials were too far away. The second furnace was put into blast in 1866 and, like its predecessor, had a river location. It used lake ore and Connellsville coke as did its successors.

In 1870 puddled iron was the backbone of American metallurgy, but within two decades steel displaced it for all ordinary uses. Wheeling introduced Bessemer converters just as soon as it realized steel's superiority over iron as a nail-making material.

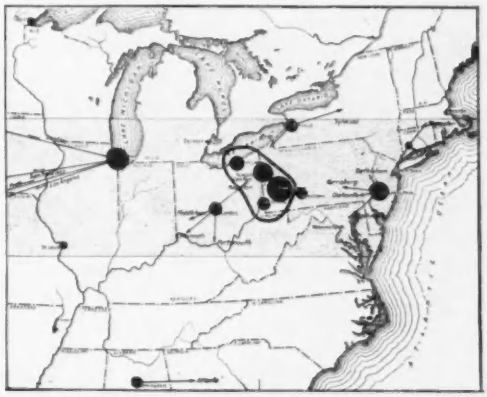

FIGURE 1.—Iron and steel districts in the eastern half of the United States as grouped by the Federal Trade Commission in the Pittsburgh basing case (1922).

The size of the circles is proportional to the ingot capacities of the districts. The arrows point to cities having plants that are included in this particular districting scheme. The shaded portion represents the zone of densest steel consumption and the area bounded by the heavy black line is the Middle District—the greatest metallurgical region in the world. (Data from *The Iron Age*.)

The next major development in this kaleidoscopic industry shook Wheeling to its very foundations: the newly-invented wire nail threatened to supersede the cut nail at the very time Wheeling's nail workers were striking. Such a situation was serious indeed for a city whose welfare depended almost entirely upon the cut nail. But the manufacturers stood steadfastly to their established product, failing to realize that all progress is predicated upon change. Had they shifted to the new product, they could have continued, unbroken, long-established business relationships with the nail trade. But by failing to change, they were soon beaten, finally forced to turn to unfamiliar products such as bars, sheets, tin-plate, and pipe, which involved the development of new marts and of

new classes of specialized labor, and they lost for Wheeling for all time the prestige it had enjoyed as nail capital of the world. Thus, whereas the district had more than 200 puddling furnaces and some 1,400 nail machines with an annual capacity of 2,800,000 kegs of nails in 1885, it had within 20 years not one puddling

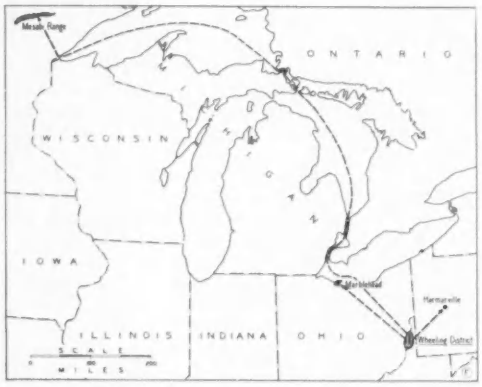

FIGURE 2.—Sources of the Trinity of raw materials for the district's blast furnaces—ore (Mesabi Range), coal (Harmarville), and limestone (Marblehead).

furnace in operation and only two establishments making nails.

THE WHEELING DISTRICT

Since the Wheeling Steel Corporation *is* the iron and steel industry in the river section from Steubenville to Portsmouth, and since its numerous units are interdependent and effectually tied together by the Ohio River, there is strong geographic and economic justification for considering as the Wheeling District this whole sweep of riparian iron and steel agglomeration (Fig. 3). But since this would violate the conception long recognized by the "trade," the district in this paper will be regarded as comprising Wheeling and its satellites—Bellaire, Benwood, Martin's Ferry, and Warwood (Fig. 4).

SITE OF WHEELING

Wheeling is situated in that part of West Virginia dubbed the Pan-Handle—a narrow peninsula wedged in between Ohio and Pennsylvania. It lies on the Ohio River at the debouchure of Wheeling Creek, 90 miles below Pittsburgh and 889 miles above Cairo. Fortunately for Wheeling, the current hugs the left bank, save for a short stretch near the head of Wheeling Island, thereby facilitating anchorage and terminal construction.

Like nearly all parts of the Allegheny Plateau, the Pan-Handle section is maturely dissected—the surface irregularities reflecting unequal rock hardness; the softer layers have been eroded, while the more resistant ones form bluffs and hills. All the streams flow in deep-cut valleys, the master stream, the Ohio, having carved out a real gorge. From any eminence, however, the whole region appears rolling (Fig. 5) and some distance back from the Ohio, the valley is hardly noticeable and the tops of the hills all appear to be at about the same general level.

Obviously paucity of land imposes a genuine hardship upon the district's land-hungry metallurgical industry. As is well known, no other industry needs such large tracts of land, since all operations are carried on in single-story buildings. Especially do open-hearth mills need plenty of space for their batteries of furnaces. It is significant in this connection that Wheeling has never had an open-hearth furnace and the reason would appear to be the cramped quarters imposed by topographic conditions. Bessemer furnaces, on the other hand, which require little space, were introduced

soon after their invention and adoption.

It should not, however, be thought that the wide distribution of the Wheeling Steel Corporation's plants (Fig. 3) is consequent solely upon lack of room; it is more a result of the merger of several separate units in different communities. The corporation was formed in 1920 by three independent companies each of which was facing serious problems following the World War. No one was self-contained in the true sense of the word, and since their requirements were complementary, consolidation seemed highly desirable.

DISTRIBUTION OF PLANTS

All the plants are concentrated along streams, especially the Ohio River (Fig. 4), because (1) they need tremendous quantities of cheap water for cooling, gas washing, and steam; (2) they must benefit from economical water transportation on fuel, on the interplant movement of products, and on manufactured materials; (3) they must be located advantageously with reference to the railways, which follow the water courses, and which bring thither the coke from Follansbee, the ore from Lake Erie ports, and the limestone from Sandusky, and (4) they must have level land and little is available elsewhere.

The distribution of plants in the Wheeling District resembles to a marked degree that in the Pittsburgh District and for the same environmental reasons. Surprisingly little level land is available in extensive tracts, because of the steep valleys and the narrow flood plains. Moreover, the railways, quick to appreciate the strategic and economic value of water-level routes, preëmpted at an early date much potential industrial land for trackage and yards. Scientific plant arrangement, such as exists, for instance, at Sparrows Point, Maryland, is absolutely out of the question here. Moreover, these mills are old, as reckoned in terms of iron and steel longevity, whereas those at Sparrows Point are mere infants.

FIGURE 3.—Properties of the Wheeling Steel Corporation, which dominates the Ohio River metallurgical industries below Pittsburgh.

Since every single plant has a waterside location, the handicap of restricted land area is compensated in part by economical transportation on both raw materials and semi-finished and finished products. The manufacturers operate their own towboats and barges and have modern mechanical handling cranes and devices.

ASSEMBLY OF RAW MATERIALS

Since the cost of assembling ore, fuel, and limestone is a critical factor in iron making, that district which assembles most economically enjoys a distinct advantage over its less fortunate rivals, providing, of course, it has ready and economical access to markets. Seldom is a district near all its raw materials: only Birmingham in the United States sits astride of all three.

While Wheeling has gas and steam

coal of high quality, it lies some distance from coking coal (Fig. 2). But this disadvantage is apparent rather than real, since coking fuel is

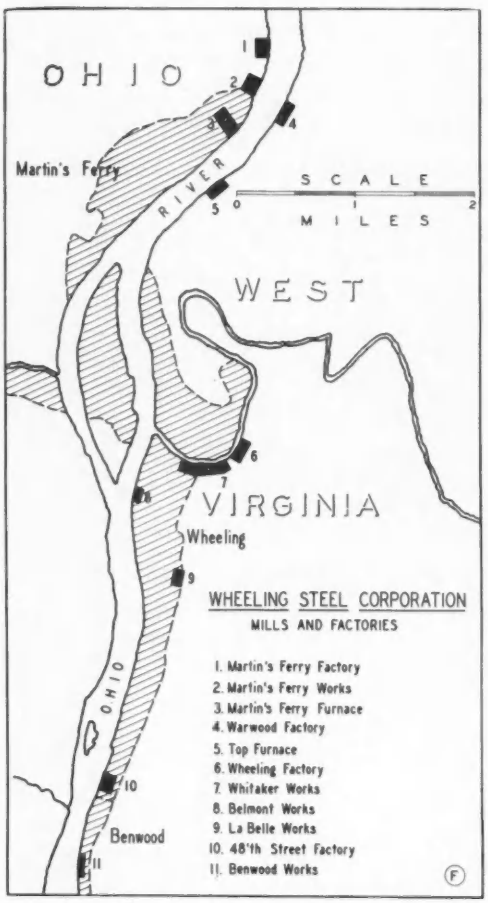

FIGURE 4.—The Wheeling District as known to the "Trade."

freighted economically from mine to oven via barge. This coal emanates from Harmarville (Fig. 2), where the Wheeling Steel Corporation owns a great mine on the Allegheny River, about 12 miles above Pittsburgh. The coal, from a tipple on the water's edge, drops into steel barges which are towed downstream aided by the rapid current to Follansbee (East Liverpool), West Virginia, 83 miles distant, where it is unloaded rapidly and efficiently and converted into coke. This mode of transport—e.g., the towing of barges in small fleets—is one of the most economical methods of water carriage. It is estimated that the cost per ton mile on 6,000 ton lots from the mine to the coke ovens does not exceed 3 mills. Most of the barges have capacities of 1,000 tons and frequently one tow boat propels as many as half a dozen barges—6,000 tons or the equivalent of 120 average gondola cars.

Of approximately 1,000,000 tons of coal floated down the Allegheny River, mostly from Harmarville, the bulk goes to Follansbee. The coke, save that which moves across the river to Steubenville over the corporation's own bridge (Fig. 5), is distributed by rail to blast furnaces as far down as Wheeling—19.5 miles away.

The coal for making gas and steam is mined at Wheeling and nearby points. The Wheeling Steel Corporation owns 10 mines with sufficient reserves to care for the needs of the mills for more than a century at the present rate of consumption.

A little natural gas is used, but, on account of its high cost, the total consumption is practically negligible.

Like nearly all other districts in the United States, Wheeling lies far from the Lake Superior iron region. From an economic standpoint, however, the distance is materially shortened by the Great Lakes, which enable ore to be shipped about 1,000 miles for 70 cents per ton. The cost is only $1.61 per ton from the mines to lower lake ports. Obviously relative to ore, Wheeling is handicapped in comparison with any lake district, inasmuch as the ore has to be handled an extra time and shipped 166 miles by rail at a cost of $1.15. But this disadvantage does not offset the double advantage of cheap fuel and

FIGURE 5.—East Steubenville Works of the Wheeling Steel Corporation. Note the dearth of level land, the rolling topography, and the ice in the river. (Courtesy of Wheeling Chamber of Commerce.)

river barge distribution of manufactured products.

The Wheeling Steel Corporation, through a subsidiary, owns two open pit mines in the Mesabi Range of Minnesota (Fig. 2). This ore is transported in large steel freighters, owned and operated by an affiliated organization, to the several Lake Erie ports. Despite the fact that the distances from these ports to Wheeling vary considerably, e.g., 145 miles from Ashtabula, the nearest, to 262 from Toledo, the farthest, the rates are the same, $1.23 per ton on "direct" ore and $1.48 on "dock" ore.[2] Superior rail connections from one or two ports to the various plants in the Wheeling District apparently account for their larger shipments of ore.

In 1929 the Wheeling District received 415,000 tons of ore, but Wheeling itself got none of this, since its only blast furnace, the Top Furnace, had recently been dismantled and abandoned in favor of the Riverside Furnace, which is almost adjacent to the Benwood Works, thus eliminating shipping and making it possible to run hot iron from the blast furnace directly to the converter. It costs $2.97 to ship a ton of ore from the Mesabi Range to Wheeling, a distance of approximately 1,045 miles.[3] This is the same rate as to Pittsburgh.

[2] "Direct" ore is delivered from ship to waiting railway cars under the unloading machines for immediate shipment to inland furnaces, whereas "dock" ore is placed in huge stock piles at the rear of the unloaders and carried inland during the winter.

[3] Hibbing to Duluth-Superior—84 miles; Duluth-Superior to Huron—795 miles; Huron to Wheeling—166 miles.

Wheeling has to depend upon distant sources for its limestone, but again this is less serious than might be supposed since comparatively little is used. For instance, in making a ton of pig iron, only 900 pounds of fluxing stone are used in comparison with 4,000 pounds of ore and 2,050 pounds of coke. This does not mean that the industry is oblivious to the location of its limestone; in fact just the reverse is the case, *but limestone never determines the location of blast furnaces*, as do the other two members of the trio. Wheeling gets its stone from northern Ohio near Marblehead (Fig. 2), where the deposits lie close to the surface, vary from 60 to 110 feet in thickness, and contain 88 per cent calcium carbonate.

WHEELING'S MARKETS

Since three of the five largest producing districts—Pittsburgh, Youngstown, and Cleveland—lie nearby, Wheeling faces intense competition in the marketing of its products in the Middle West, save the five per cent disposed of locally. Great marts lie in the Middle West, South, Southwest, and West, where Wheeling disposes of some 95 per cent of its products. Much of this region, of course, is outside Wheeling's natural market area from a rail-rate basis and would doubtless be locked to it, but for the economies of river carriage. It seems certain that without the navigable Ohio, Wheeling would be reduced metallurgically to supplying the wants of its local market. The abolition of "Pittsburgh Plus" undoubtedly made transportation costs more vital to the steel interests in the Middle District than they ever had been before. Assuredly, that was the goad that brought forth industrial navies and sent them over the waters of the Ohio and Mississippi Rivers to break through the cordon of high rail freight rates. Hundreds of thousands of tons of all kinds of iron and steel products from Pittsburgh, Steubenville, Wheeling, and Portsmouth are now floated down the rivers to

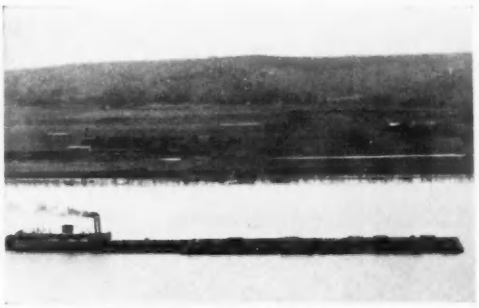

FIGURE 6.—A tow of finished steel products from the Wheeling District moving down the Ohio River. (Courtesy of Wheeling Chamber of Commerce.)

southern points. Delivery takes place throughout the year, navigation being hindered but a few days in spring and winter by high water or floating ice. The Wheeling Steel Corporation has warehouses at Memphis and Houston, which function as supply depots for adjacent territory. Oil companies, for instance, cannot wait for pipe; they must have it when they need it. With warehouses situated at strategic points, delivery is made promptly. At New Orleans and Baton Rouge, steel products destined for Houston are transferred from river to sea-going barges.

Large economies ranging from $2.00 to as much as $10.00 per ton (depending upon the distance) are effected by utilizing barge shipment. It is no longer unusual to see great fleets of shackled barges carrying 10,000 to 15,000 tons of steel products to down-river points (Fig. 6).

THE OUTLOOK

Wheeling's advantages and disadvantages for iron and steel manufacture have been presented. The district does not have such low assembly costs on raw materials or such large local markets as do several of its competitors. Nor does it have such scientific distribution of plants as some of its youthful rivals, since flat land along the Ohio is at a premium and since the Wheeling Steel Corporation is the result of the merging of many separate units of long standing. On the other hand, efficient use has been made of what is at hand, an outstanding example of which is the extensive use made of waterways, for the delivery of fuel and ore, for the interplant movement of materials, and for the distribution of the bulk of its finished and semi-finished products to distant markets.

Could America's metallurgical industry begin anew, based upon present knowledge of scientific plant location, the writer feels certain that Wheeling would not occupy a prominent place on the iron and steel map of the nation. It is, and has been, slipping for some time. The fact that the United States Steel Corporation has, since its inception in 1900, abandoned several plants in the district, may be prophetic. Perhaps it can more advantageously modernize its Pittsburgh than its Wheeling plants or add new ones in Gary. But why conjecture thus when the iron and steel industry is so well established? Wheeling seems destined to retain its reputation as a great steel center, because of early start; tremendous financial investment in plants, railroad equipment, shipping fleets, and mineral resources; permanent decentralization of the American metallurgical industry; appreciable local market; propinquity to high-grade fuel; commercial rejuvenation of the Ohio River; strong steel tradition among its people; and up-to-dateness of the Wheeling Steel Corporation, which has the largest continuous sheet mill in the world and is the pioneer producer of Cop-R-Loy,—a rust-resisting steel.

COMPETING COTTONS AND UNITED STATES PRODUCTION

William G. Reed

ALTHOUGH cotton is only one of the textile raw materials, it is probably the most important. Wool and flax have doubtless been used by man for a much longer time than has cotton; silk is a more aristocratic fibre; rayon and the other chemical fibres are newer; and jute and the hemps are cheaper. The fact that cotton has to a considerable extent replaced wool, flax, and silk; has, in turn, held its own against jute and hemp; and is threatened by the chemical fibres only in minor details, suggests that it has properties which make it preëminent as a textile raw material.

Among these properties are the suitability of cotton for mechanical spinning and the wide range of yarns and cloths which can be made from cotton; compared with fibres which will give comparable results cotton is relatively cheap; cotton is an annual crop which can be grown in quantity in many countries and, since the invention of the cotton gin in 1793, has been produced at less cost than any other textile fibre except jute and the hemps which are unsuited for most of the goods normally made from cotton.

Textile Fibres

The textile fibres form a large group of animal and vegetable products, which have in comparatively recent times been supplemented by man-made fibres. The uses to which the textile fibres are put are such that there can be a good deal of replacement of one fibre by another in case the user so desires. The reasons for the desire to substitute one fibre for another are many and various. Probably the most important reasons are those connected with cost, either first cost of the cloth or ultimate cost considering the life of the material; availability, style factors, relative suitability of the product for the use to which it is to be put, and many other reasons also determine the choice of the raw material.

Cotton is only one of the textile fibres and the cottons themselves, while closely related botanically, really include a variety of fibres having somewhat different properties. The commercial competition between different cottons is frequently of less importance than the competition between a particular cotton and some other fibre. For instance, the rough short cotton grown in China has little in common, except botanically, with the smooth long cottons of the Mississippi Delta, Egypt, and elsewhere, but it does come into competition with wool. On the other hand, the long cottons are little concerned with wool as a competitor; but, especially in the case of hosiery yarns, they have felt the pressure of the cheaper grades of silk and of the chemical fibres. Again, the short cottons of India and the lower end of the American crop have nothing to fear from wool or silk; but the coarse goods made from them are in active competition with burlap and paper, although they compete only to a

FIGURE 1.—Picking cotton in Northern Algeria. The stand is not very dense. (Courtesy of U. S. Bur. of For. and Domestic Commerce.)

very limited extent with the longer cottons.

BASIS FOR GROUPING COTTONS

Owing to the different products made from different qualities of cotton, it is desirable to divide the world's commercial cottons in such a manner as to include in the same group cottons which are competitive and to exclude cottons which are not competitive with each other. It must be recognized that the ultimate test of the quality of cotton is to be found in the results of its action in the spinning machinery and in the character of the yarn and goods which can be satisfactorily produced. However, in spite of numerous attempts to define quality scientifically, the results have not been wholly successful. It is recognized that among the factors which combine to make up "quality" are the lengths of individual fibres, the distribution of these lengths in the particular cotton, the strength of the individual fibres, the cross-section of the individual fibres, and the character of the surface of the individual fibres, as well as many others less easy to define. While the spinning machinery integrates all the factors going to make up quality, cotton merchants, mill buyers, and others who handle cottons in large quantities, need a simpler concept for practical working standards.

The construction of the spinning machinery is such that in order to run a particular cotton the rolls are set accurately a certain distance

FIGURE 2.—A native "compressor" in the Anglo-Egyptian Sudan. (Courtesy of U. S. Bur. of For. and Domestic Commerce.)

apart and this led spinners to describe the cotton they desired in terms of length, that is, the distance between the rolls. Because spinners spoke of "staple length," attempts were soon made to apply this length to the cotton itself—in other words, to smooth out a small portion of the cotton and measure accurately the length of the bulk of the fibres. In

VISIBLE SUPPLY (In 1000's).

THIS WEEK.	Amer.	Brazilian.	Argentine,&c.	Peru. &c.	Egypt.	Sudan Sakel	Sudan Other	West Ind.&c	East Afr.&c	West Af'can	East Indian.	Sundries	Total.
Stock—Liverpool, &c..	258	17	28	62	63	51	28	7	16	25	6	71	632
,, Manchester	47	..	3	5	21	7	..	..	..	..	40	16	139
Afloat—Great Britain..	147	6	8	19	22	3	2	1	4	1	3	43	259
Total for Great Britain	452	23	39	86	106	61	30	8	20	26	49	130	1030
Stock—Continent	565	2	4	9	17	..	..	2	3	4	14	14	634
Afloat—Continent, &c..	333	3	1	10	12	..	..	1	1	1	29	2	393
Total for Continent ..	898	5	5	19	29	..	..	3	4	5	43	16	1027
Stock—United States..	7008	..	..	..	..	..	..	..	..	..	..	..	7008
,, Alexandria	..	..	..	..	748	..	..	..	..	..	..	..	748
Afloat Bombay Harbour	..	..	..	..	..	..	..	..	..	..	1	..	1
Stock & Afloat Orient..	731	..	..	..	..	..	..	..	..	..	..	..	731
Total	7739	..	..	..	748	..	..	..	..	..	1	..	8488
GRAND TOTAL	9089	28	44	105	883	61	30	11	24	31	93	146	10545
LAST WEEK.													
Stock—Liverpool, &c..	227	20	28	63	51	52	30	7	13	26	5	74	596
,, Manchester	38	..	4	5	20	7	..	..	..	..	41	17	132
Afloat—Great Britain..	170	7	6	20	33	2	2	1	4	1	7	23	276
Total for Great Britain	435	27	38	88	104	61	32	8	17	27	53	114	1004
Stock—Continent	468	2	5	9	17	..	..	2	3	4	15	15	540
Afloat—Continent, &c..	456	4	1	10	19	..	..	1	2	2	39	2	536
Total for Continent ..	924	6	6	19	36	..	..	3	5	6	54	17	1076
Stock—United States..	6906	..	..	..	..	..	..	..	..	..	..	..	6906
,, Alexandria	..	..	..	..	727	..	..	..	..	..	..	..	727
Afloat Bombay Harbour	..	..	..	..	..	..	..	..	..	..	..	..	..
Stock & Afloat Orient..	659	..	..	..	..	..	..	..	..	..	..	..	659
Total	7565	..	..	..	727	..	..	..	..	..	..	..	8292
GRAND TOTAL	8924	33	44	107	867	61	32	11	22	33	107	131	10372
LAST YEAR.													
Stock—Liverpool, &c..	343	41	13	104	22	82	31	4	15	36	16	..	707
,, Manchester	60	..	1	4	24	14	..	..	..	4	25	..	132
Afloat—Great Britain..	148	7	3	18	24	..	..	1	3	1	21	..	226
Total for Great Britain	551	48	17	126	70	96	31	5	18	41	62	..	1065
Stock—Continent	739	9	12	13	13	..	..	3	14	3	46	..	852
Afloat—Continent, &c..	478	2	1	9	21	..	..	1	2	1	49	..	564
Total for Continent ..	1217	11	13	22	34	..	..	4	16	4	95	..	1416
Stock—United States..	5932	..	..	..	4	..	..	..	..	..	..	..	5936
,, Alexandria	..	..	..	..	650	..	..	..	..	..	..	..	650
Afloat Bombay Harbour	..	..	..	..	..	..	..	..	..	..	1	..	1
Stock & Afloat Orient..	303	..	..	..	..	..	..	..	..	..	..	..	303
Total	6235	..	..	..	654	..	..	..	..	..	1	..	6890
GRAND TOTAL	8003	59	30	148	758	96	31	9	34	45	158	..	9371

FIGURE 3.—A portion of the "Liverpool Cotton Association Weekly Circular" for Friday, November 27, 1931, showing the stocks of various growths of cotton making up the "Visible Supply."

practice this works fairly well, and cotton merchants have adopted the measurement of the bulk of the fibres in a given lot of cotton as a method in determining its value. Although staple length is now a fundamental in the commercial classification of cotton, the measured length of the fibre is of less importance than spinning performance. In some cases characteristics of the fibre are such that spinning performance is the same for cotton of different staple lengths measured in accordance with the usual commercial practice, but generally the measured lengths do not vary by more than $\frac{1}{16}$" except in the case of the very long cottons.

GROUPING BY COUNTRY OF GROWTH

An obvious method of describing cotton has been that of indicating the country of growth, such as "American Cotton," "Egyptian Cotton," "Indian Cotton." This method does, in a general way, indicate the staple characteristics. A single region has similar climatic and soil conditions so that the cottons produced in a single country have much in common. This does not

Prices paid this week. (Pence per lb.)		DESCRIPTIONS.	OFFICIAL SPOT QUOTATIONS. (Pence per lb.)									Same time 1930. (Pence per lb.)
3·85	7·85	American "Fair Staple."	G.O. 4·20 *40 off*	S.G.O. 4·50 *10 off*	L.M. 4·70 *10 on*	S.L.M. 4·80 *20 on*	Mid. 4·90 *30 on*	S.M. 5·00 *40 on*	G.M. 5·20 *60 on*	S.G.M. 5·60 *100 on*	M.F. N6·05 *145 on*	Mid. 5·91 *25 on*
		Brazilian.			Mid. Fair.		Fair.		Good Fair.			Fair.
4·95	5·35	Pernam, Maceio, &c.			N4·55		4·90		5·20			5·86
6·10	—	Parahyba, Rio Grande, &c.			N4·50		4·90		5·20			5·86
—	—	Ceara, &c.			N4·35		4·80		5·05			5·76
—	—	São Paulo			N4·45		4·80		5·05			5·76
4·60	5·89	Argentine, &c.	—		—		—		—		—	—
		Peruvian, &c.	Mid. Fair.		Fair.		Good Fair.		Good.		Fine.	Good.
4·20	7·06	Tanguis	N5·50		5·75		6·10		6·45		7·45	6·91
6·10	—	Smooth	N5·10		N5·30		N5·50		N5·80		N6·20	N6·76
6·37	—	Mitafifi	—		N5·75		N6·25		N6·75		N7·50	N6·75
5·25	7·50	Pima	—		—		—		—		—	—
4·85	—	Rough, &c.	—		—		—		—		—	—
		Egyptian.	Fair.		Good Fair.		F.G.F.		Good.		Fine.	Ex. Fine.	F.G.F.
5·20	10·25	Sakellaridis	6·30		6·80		7·15		8·35		9·35	N12·50	9·35
4·85	6·50	Upper	5·27		5·46		5·59		5·97		6·32	N6·73	6·58
6·34	8·05	Pilion	N5·35		N5·65		N5·99		N6·30		N6·85	N7·70	N7·35
		Other Growths	—		—		—		—		—	—	—
4·62	7·25	Sudan Sakellaridis	—		—		—		—		—	—	—
3·87	6·60	Sudan Other	—		—		—		—		—	—	—
		West Indian, &c.	Fair.		Good Fair.		Good.		Fine.		Ex. Fine.	Good.
4·87	5·00	Do. Sea Island	—		6·30		5·80		6·55		7·05	6·70
—	—		—		—		—		—		—	N21·00
4·35	6·10	East African	5·55		5·80		6·10		6·85		—	N7·66
			G.O.	S.G.O.	L.M.	S.L.M.	Mid.	S.M.	G.M.	S.G.M.	M.F.	G.M.
5·10	5·85	aSouth African	N4·20	N4·50	N4·70	N4·80	N4·90	N5·00	N5·20	N5·60	N6·05	(Native Seed.)
4·95	5·31	bWest African	—	—	4·60	4·80	4·90	5·00	5·10	5·35	—	N6·11
		East Indian "Fair Staple."	G. Fair.	F.G.F.	Good.	F. Gd.	Fine.	S'fine.	Choice.	S'Choice.		
		S.G. Punjab/American	—	—	—	—	N4·61	N4·76	N4·91	—	—	—
		M.G. Punjab/American	—	—	N4·23	N4·38	4·53	4·68	—	—	Fine	N5·10
		Cambodia	—	N4·82	N4·94	N5·06	—	—	—	—		—
		cTinnevelly	N4·60	N4·72	N4·84	—	—	—	—	—	Good	5·55
		Surtee	—	—	—	N4·62	N4·74	N4·86	N4·98	N5·10	Fine	N5·35
		Broach (Good Staple)	—	—	—	N4·39	N4·51	N4·63	N4·75	—	Fine	N4·60
		dWestern	—	N4·17	N4·32	N4·47	—	—	—	—	Good	N4·15
4·25	4·38	dNorthern	—	N4·32	N4·47	N4·62	—	—	—	—	Good	N4·40
		Coconada	(Fair Red M.G. N4·42)				(Fair Red H.G. N4·42)				Fair M.G.	N4·20
		Comptah	N4·47	—	N4·77	—	—	—	—	—	Good	N4·80
		C.P. Oomra (Oomra No. 1 Staple)	—	—	—	—	4·46	4·61	4·76	—		—
		gOomra (No. 1 Staple)	N3·91	N4·01	N4·11	N4·21	N4·36	4·51	4·66	N4·81	Fine	N4·20
		Khandeish	—	—	N3·86	N3·96	N4·11	—	—	—	Fine	N3·90
		Bengal	N3·76	N3·86	N3·96	N4·06	N4·16	N4·26	N4·36	N4·46	Fine	N3·90
		Sind	—	—	—	N4·06	N4·16	N4·26	N4·36	N4·46	Fine	N3·90
4·70	5·80	Sundries	—	—	—	—	—	—	—	—		—
—	—	China	(No. 2, N5·95)		(No. 1, N6·25)		—	—	—	—		No. 1. 5·75
			Extrissima.		Superior.		Prima.	Saw Ginned. No. 2.	No. 1.	American Seed. No. 2.	No. 1.	Amer. Seed. No. 1.
4·20	—	Adana	N4·07		N4·37		N4·57	N3·82	N4·12	N4·52	N4·77	N5·35

FIGURE 4.—A portion of the "Liverpool Cotton Association Weekly Circular" for Friday, November 27, 1931, showing the prices quoted for the various qualities of cotton and the varieties recognized.

mean that different varieties are not planted, or that different qualities of cotton are not grown in the same region. However, in any given region, one or, at most, a limited number of cottons prove most profitable as a result of the growing conditions. Therefore, the description of cottons by country of growth has much to commend it. It is true that in many instances this practice has had unfortunate results, as it has prevented cotton superior to that of the average run of the region from receiving a better price than the average. In other cases, inferior cotton has received the price of the average, and any considerable quantity of inferior cotton has hurt the reputation of the district.

In spite of the objections to the method of describing cotton by the country of growth, this has been the practice of the Liverpool Cotton Exchange, where there is trading in more growths of cotton than anywhere else in the world. This has probably not been of great importance in the British markets, as British spinners usually examine samples of the actual cotton offered before completing a purchase. The Liverpool daily and weekly market reports regularly show prices and warehouse stocks of the following kinds of cotton:

American	Sudan Other
Brazilian	West Indian, etc.
Argentine, etc.	East African, etc.
Peruvian, etc.	West African
Egyptian	East Indian
Sudan Sakel	Sundry

Although stocks are usually reported only for the groups as indicated, as is shown by Figure 1, prices for a number of varieties are quoted in nearly all the groups (see Figure 2). These varieties differ one from another mainly in staple. For each variety a number of grades are quoted, but grade is mostly the result of picking and ginning conditions and is apart from the staple characteristics.

The spinnable cottons range in staple length from about ¾″ to two inches or more. Spinnable cottons represent the bulk of the world's commercial cotton crops.

Unspinnable Cottons

The unspinnable cottons (Group 1) are rough and wiry and are used mostly for wadding and blankets. They are used mainly in connection with wool or as substitutes for wool,

TABLE I

SUGGESTED CLASSIFICATION OF THE COMMERCIAL COTTONS OF THE WORLD BY COMPETING GROUPS

Group	*Normally Suited for Spinning Yarns of English Count*	*Typical Goods Made from These Cottons*	*Staple Length of the American Cotton Normally Used*	*Typical Cotton*	*Countries Representing the Principal Production of These Cottons*
1	Barely spinnable	Blankets, wadding, and felts	None grown in United States	Tientsin	North China, India, Dutch East Indies
2	0 to 15s	Very coarse goods	Under ⅞″	Indian Oomra	India, China, United States
3	15s to 25s	Sheetings	⅞″ to 1″	American Bowed	United States, Mexico, India, Russia, South Brazil, Argentina
4a	25s to 40s	Print cloths	1″ to 1 1/16″	Texas Staple	United States, Russia, Brazil, Argentina, South Africa, West Africa
4b	40s to 60s	Shirtings Medium tire yarns	1 1/16″ to 1⅛″	Memphis	
5a	60s to 75s	Dress goods Tire yarns	1⅛″ to 1 3/16″	Egyptian Uppers	Mississippi Delta, Carolinas, Egypt, Peru, North Brazil, Sudan, East Africa, Haiti
5b	75s to 80s	Fine knitting yarns Fine insulating yarns	1 3/16″ to 1¼″	Longest Delta Staples	
6	Above 80s	Laces and lawns Sewing thread Best tire yarns	1¼″ and longer	Sakellaridis Sea Island	Arizona, Egypt, Sudan, Peru, British West Indies

STAPLE GROUPS

However, growth alone is not a satisfactory method of showing staple qualities and further refinements are necessary, particularly as the different varieties of one growth generally compete with different growths. Table I shows a method of grouping the world's cottons on the basis of spinning performance. Probably the primary separation should be into cottons normally spun and those normally not spun. and are generally ⅜″ to ⅝″ in staple length, although the "rough" and "moderate rough" Peruvian cottons are much longer. These short rough cottons are grown in North China, the Bengal-Sind region of India, the Dutch East Indies, Persia, and the eastern Mediterranean countries. Probably many native cottons of Asia and Africa should be included, but this production is not commercially important, as the cotton is used locally and does not get into mill consumption. The available in-

formation indicates that somewhat less than three quarters of a million equivalent 500-lb. bales go into commercial channels annually: about a quarter of a million bales from China, one to two hundred thousand from India, and possibly a quarter of a million from other countries. As these cottons do not compete with the strictly spinnable cottons and are not produced in the United States, they are of little importance to the American cotton grower. However, American mills consume about forty thousand bales annually, mostly of Chinese growths.

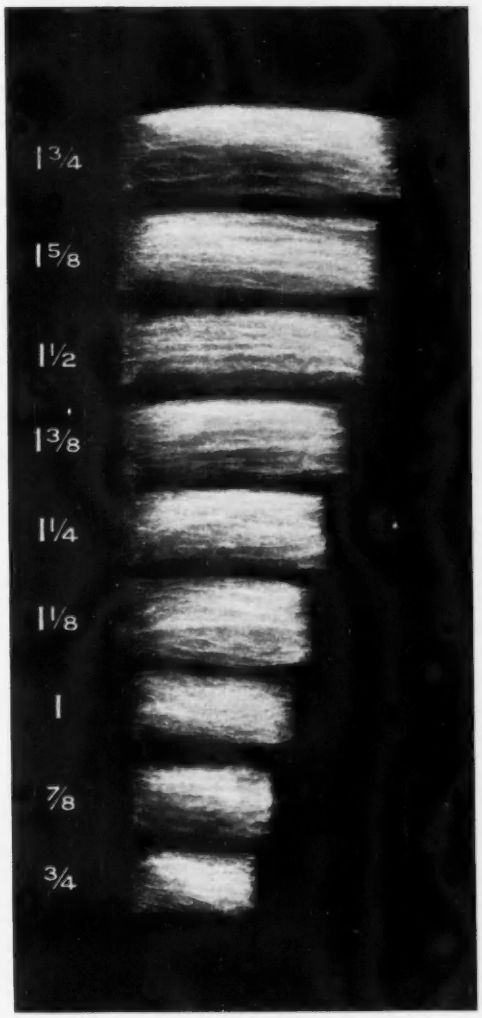

FIGURE 5.—A photographic representation of the official cotton standards of the United States of those lengths of staple for which types are available for distribution, each respective length as shown being obtained from the original type bale. (Courtesy of U. S. Bur. of Markets.)

Shortest Spinnable Cottons

The shortest spinnable cottons (Group 2), which are used for very coarse goods, have a staple length below 7/8". Previous to the past six or seven years, this cotton received little commercial recognition in the United States. Although careful examination of the cotton of certain regions showed a considerable quantity of cotton below 7/8" in staple, it was generally included with 7/8" as "short cotton" and seldom penalized in price. The extension of cotton growing into northwest Texas with its short growing season and the development of the variety known as "Half and Half" have probably been responsible for a considerable production of this very short cotton. Although it is not certain that there was any marked increase in the proportion of the American crop below 7/8", the attention of the Cotton Trade was directed to this cotton some six or seven years ago either because of the quantity appearing in Texas or because spinners had become particular with regard to staple length. The trade had been accustomed to regard cotton below 7/8" in staple length as typical of Indian and Chinese rather than American, and did not take kindly to its introduction. Agricultural leaders also advised against it, but in many instances the farmer seems to have been able to realize more per acre for 13/16" cotton than for any longer staple. Therefore, while sentiment in the trade suggests that this short cotton has little place

FIGURE 6.—The Lyallpur India cotton market, typical of the "up-country" districts. (Courtesy of U. S. Bur. of For. and Domestic Commerce.)

in the American cotton production, economic factors may cause it to remain there.

The record of American production since 1928 is as follows:

Season	*Running Bales*	*Per Cent of Crop* (Approximate)
1928–1929	2,047,000	14
1929–1930	2,920,000	20
1930–1931	1,834,000	13

The production this year (1931–1932) will be smaller, probably not quite reaching a million equivalent 500-lb. bales, the total in running bales probably being about fifty thousand less.

India is the principal country in which this quality of cotton is produced; the Oomra variety of Indian cotton is regarded as typical for the group. On the average at least 70 per cent of the Indian production is below 7/8″ in staple length, all of this cotton except one to two hundred thousand equivalent 500-lb. bales of rough cotton belonging in Group 2. Present indications suggest that the Indian production of this cotton this year will be less than two and a quarter million bales, nearly a million less than was grown in 1930–1931.

Except for the rough cottons of North China, some 90 per cent of the Chinese cotton used by mills is of this quality. The total cotton production of China is unknown as much of the cotton is used in the households of the cotton farmers. The so-called "commercial crop," that is, the cotton used by Chinese mills and exported, averages about a million and three quarters equivalent 500-lb. bales, of which about a million and a quarter to a million and a half belong in Group 2. Owing to floods in central China this year the crop has been greatly reduced. Present information suggests that only about three quarters of a million bales of

this quality of cotton will go into commercial channels, a reduction of about 40 per cent from last year. Aside from India, China, and the United States, very few countries produce cotton of Group 2. This production is so scattered and unimportant that it cannot be separated in the estimates from 7/8" cotton on the one hand, or from the rough short cottons on the other.

Typical American Cotton

Group 3 is the typically American cotton. It has a staple length of 7/8" to 1"; and is used for goods of which sheetings may be taken as an example. Production in the United States has been as follows:

Season	*Running Bales*	*Per Cent of Crop* (Approximate)
1928–1929	9,191,000	64
1929–1930	8,285,000	57
1930–1931	8,743,000	64

This year Group 3 will probably include nearly 68 per cent of the American crop; on the basis of the mid-February outlook this will amount to more than eleven and a quarter million equivalent 500-lb. bales, or about eleven million running bales.

Cotton of this quality is also produced in India, where possibly 30 per cent of the average production may be considered competitive with American 7/8" cotton although the measured staple of the Indian in the group frequently falls slightly below 7/8". Production this year is indicated at about a million equivalent 500-lb. bales, a decrease of about a quarter of a million from last year.

Russia is becoming important as a producer of cotton competitive with Americans. The total production is increasing rapidly and this year is estimated at a million nine hundred thousand bales. There is little accurate information as to the staple length of Russian cotton, except for that of some of the exports. What little information is available indicates that possibly 25 to 35 per cent belongs in Group 3, and the other 65 to 75 per cent in the next longer group. This suggests that production of Group 3 cotton in the current season will be nearly six hundred thousand bales, an increase of a hundred thousand from last year.

Other production of cottons belonging to this group includes practically all the Mexican crop except that grown in Lower California, possibly a hundred thousand bales or more of the Chinese crop, and around half of the cottons of southern Brazil, Argentina, and Paraguay. The Mexican production is estimated this year at about a hundred and fifty thousand bales, an increase of forty thousand over last year; the South American countries will produce nearly two hundred thousand bales, or about 10 per cent more than last year. There is some scattered production in other areas which may amount to fifty thousand bales annually.

Somewhat Longer Cottons

The next longer group, based on spinning performance, is that of cottons normally suited for yarns of 25 to 40 counts; this is the typical cotton used for print cloths. The group is designated as "4a" in Table 1. The cotton required has a staple length of 1" to 1 1/16" in the case of American cotton, but the different characteristics of other growths make measured staple length less important, with the result that these cottons are harder to separate. The production of cotton of 1" to 1 1/16" staple length in the United States in recent years has been as follows:

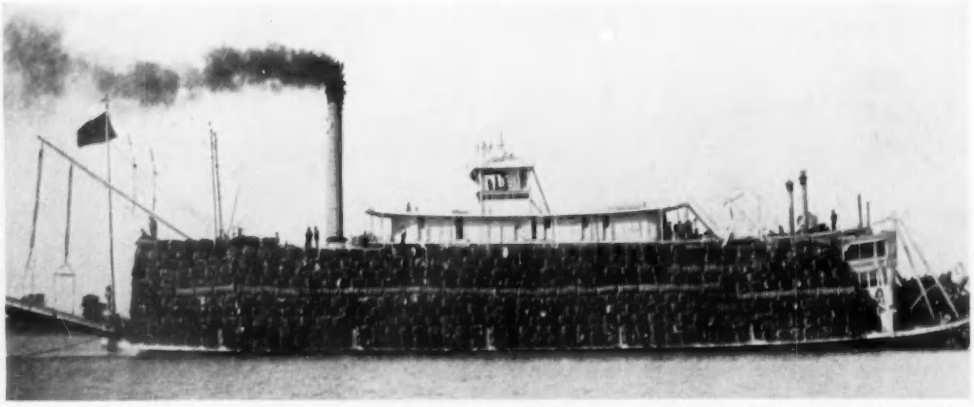

FIGURE 7.—River transport in the great Mississippi Valley cotton belt, at the height of the ginning and shipping season. (Courtesy of Mr. Barclay McFadden.)

Season	*Running Bales*	*Per Cent of Crop* (Approximate)
1928–1929	1,605,000	11
1929–1930	1,693,000	12
1930–1931	1,742,000	13

This year's production is indicated at about 15 per cent of the total crop, or two and a half million bales.

Because of the difficulty in separating the foreign growth cottons, it has been necessary to combine the group of cottons mormally suited for spinning 40s to 60s (Group 4b) with the next lower group (4a). Group 4b cotton is used typically for shirtings and medium tire yarns. American cotton used for this type of work normally has a staple length of $1\frac{1}{16}''$ to $1\frac{1}{8}''$. Much of this cotton is grown in eastern Arkansas and other portions of the Mississippi Delta, although its production is not confined to that section. American production has been as follows:

Season	*Running Bales*	*Per Cent of Crop* (Approximate)
1928–1929	765,000	5
1929–1930	937,000	6
1930–1931	967,000	7

Production this year is indicated at about 6 per cent of the total crop, or nearly a million bales.

Foreign growth cottons normally used for counts of 25 to 60, that is cottons used on the same work as American $1''$ to $1\frac{1}{8}''$, are produced chiefly in Russia, southern South America, and West and South Africa. Probably 70 per cent of the Russian cotton should be placed here, the bulk of it being included in the lower sub-group (4a). On the basis of the estimates now at hand, this means a production in Russia for the current season of about a million three hundred thousand bales, an increase of a quarter of a million over last year.

About half the cottons of Argentina, Paraguay, and southern Brazil apparently belong in Group 4, mostly in the lower part of the group. Although most of the cotton produced in northern Brazil is used for finer work than the cottons of Group 4, an appreciable amount should probably be assigned to this group. South America is expected to produce about two hundred thousand bales of this cotton during the current season, which is about the same as last year. Practically all the West and South African commercial cottons should be placed in Group 4. Production amounts to about a hundred thousand bales each year. Scattering areas of production elsewhere will supply

somewhat more than a hundred thousand bales this year, which is less than last year.

The cottons of this group are mostly white, and similar to American cotton in character, as the seed originally came from the United States. Some of the African and Brazilian cottons in the group are apparently brown, and more like Egyptian Uppers. However, the group as a whole is regarded as competitive with American 1″ to 1⅛″ rather than with "Uppers."

Long-Staple Cottons

Cottons longer than 1⅛″ are usually termed "Long-Staple Cottons." They are produced in comparatively small quantities and altogether have included only 12 to 15 per cent of the total commercial cotton crops of the world in the past few years. This is in spite of the enormous impetus given to their production by the development of the automobile tire industry. The Cotton Trade is accustomed to divide the long-staple cottons into two groups at about 1⅜″ staple length.

From the point of view of typical yarns, cottons of 1⅛″ to 1⅜″ fall into two sub-groups (5a and 5b of Table I). The shorter cottons (subgroup 5a) will normally spin 60s to 75s and are typically used for dress goods and tire yarns. American cotton of 1⅛″ to 1 3/16″ is used for this class of work. Production in the United States has been as follows:

Season	*Running Bales*	*Per Cent of Crop* (Approximate)
1928–1929	446,000	.3
1929–1930	556,000	.4
1930–1931	383,000	.3

As in the case of Group 4, it is not practicable to separate the foreign growth cottons of Group 5 into the sub-groups which are suggested by spinning performance. Table I shows Group 5b as including cottons normally used for fine knitting yarns and fine insulating yarns; the cotton required is that which will do the work of 1 3/16″ to 1⅜″ American. Production of this cotton in the United States in the past two years has been less than one per cent of the total crop; in 1928–1929 it was about one and a quarter per cent. The production in bales is reported as follows:

Season	*Running Bales*
1928–1929	186,000
1929–1930	127,000
1930–1931	62,000

Present indications suggest that production for all the Group 5 cottons in the United States will be about 5 per cent of the total crop this season or between three quarters of a million and a million bales. In the United States these cottons are grown mostly in the Mississippi Delta and South Carolina, although many other cotton-growing states produce some of them.

Egypt is the most important producing country for Group 5 cottons. Egyptian production exceeds that of the United States and in some years has been more than double that of this country. The varieties of Egyptian cottons included in the general term "Uppers" belong here; the other cotton grown in Egypt is longer. This year production of Group 5 cotton in Egypt is expected to be about a million equivalent 500-lb. bales, or nearly a quarter of a million less than last year.

Outside of Egypt and the United States, this quality of cotton is produced in Brazil, Peru, the Sudan, East Africa, and Haiti. South America will probably supply about four hundred thousand bales during the current season, which is the same as

last year. According to current estimates, the Sudan and East Africa together will grow about a quarter of a million bales, or 10 per cent more than last year. Haiti is estimated at about twenty-five thousand bales for both years.

The "American" (that is, United States) cotton of this group is white in color, but the other cottons are mostly brown. However, some white cotton from American seed is grown in Peru, the Sudan, and possibly in East Africa. In the recent past the brown cottons have greatly exceeded the white in quantity, sometimes running three or four times as much. The estimates for the current season suggest that the relative amount of white cottons will be much greater than in the past few years; it is not unlikely that the production of white cotton in this group will reach 40 per cent of the total, that is the production of brown cottons may be only one and a half times as much as that of white cottons.

Cottons of Group 5 have been overproduced in the past two years owing to the decline in the tire industry, but production does not seem excessive for the normal production of tires and other goods for which these cottons are required. The great increase in the United States makes the world total this year about 9 per cent larger than last year. As far as the United States is concerned, this may not be serious as the tariff on "cotton having a staple length of 1⅛" and longer" of seven cents (Tariff Act, 1930, paragraph 783) tends to check imports. However, world supplies are burdensome at present and are likely to continue so until general trade conditions improve.

The principal use of Egyptian "Uppers" in the United States is for

FIGURE 8.—Congestion at the Fort Smith Compress Company, Arkansas, at the height of the season. Thousands of bales of cotton stored temporarily in the open. (Courtesy of U. S. Bur. of Agric. Economics.)

automobile tires; how far American cotton can be employed for this purpose is a technical spinning question. It has scarcely become of commercial importance yet, owing to the depressed state of the tire industry and the stocks of cotton imported in anticipation of the tariff. However, as these stocks are reduced, the character of the competition between American staples and Egyptians will have increasing commercial significance. In the relatively few cases where white cotton is required, American cotton of this group has little serious competition; but in the case of these cottons, color is generally of little importance, and many mills consider the spinning performance of Egyptian "Uppers" and similar cottons superior to that of the competing American staples. This is possibly because they have had less experience with American cotton, but it is a commercial factor to be reckoned with.

Longest Cottons

The last group (6) which is used for very fine goods, sewing thread, and the best tire yarns includes cottons having a staple length of 1⅜" and over. There are two principal types of this cotton: Sakellaridis, a strong brown cotton which originated in Egypt; and the fine silky white Sea Islands which originated in the southeastern United States or the West Indies.

American production of Sea Islands reached over a hundred thousand bales in the early years of the present century. Since then bollweevil damage and an unsatisfactory selling system have practically eliminated Sea Island cotton in the United States. Four or five thousand bales are grown annually in the British West Indies and about a thousand bales in Porto Rico. Although there has been some attempt to grow Sea Islands in Fiji, the production is insignificant. While Sea Island cotton is without equal for some purposes, the small production has forced former users to turn to the Sakellaridis types as far as possible. The result is a vicious circle from which there is no apparent escape; production is not likely to be increased owing to lack of demand, and manufacturers are not likely to set their machinery to spin this cotton owing to the uncertainty of sufficient supplies.

With the declining production of Sea Islands and the increasing demand for strong long-staple cotton from makers of sewing thread and automobile tires, the production of cotton of the Sakellaridis type increased enormously. Egypt alone has produced more than a half million equivalent 500-lb. bales in a single season, and much of the development of cotton in the Sudan has been Sakellaridis. Production of Sakellaridis cotton in Egypt and the Sudan this year will amount to about four hundred thousand equivalent 500-lb. bales, a decrease of somewhat more than a hundred thousand from last year.

This cotton has been introduced into the United States, where the variety developed is known as "Pima" or American-Egyptian cotton. Production amounted to nearly 93,000 bales in 1920–1921, but has since fallen off; it was only 23,000 last year and is estimated at 15,000 bales this year. This decline is due to lack of demand, and competition from Egyptian cotton. There is now a considerable quantity of Pima produced in Peru. About 11 per cent of the Peruvian cotton exported in 1930 was Pima.

TABLE II

ESTIMATES OF COTTON PRODUCTION BY COMPETING STAPLE GROUPS
(Based on information available February 15, 1932)
(Approximate 500-lb. bales, 000 omitted)

Competing group (based on spinning performance)	*Group 1*		*Group 2*		*Group 3*	
Typical cotton goods made from this group	Wadding Blankets		Very coarse goods		Sheetings	
Normally suited for spinning yarn counts	Barely spinnable		0 to 15s		15s to 25s	
Staple length of American cotton in the group	None grown		Under 7/8"		7/8" to 1"	
Growing Season	1931–32	1930–31	1931–32	1930–31	1931–32	1930–31
United States	16,800	14,018	...	...	11,380	8,916
Mexico	185	154	...	...	157	112
Egypt	1,286	1,661	...	...	....	....
Sudan	145	106	...	...	....	....
India	3,360	4,585	106	120	1,035	1,275
China	1,100	1,603	280	233	75	125
Russia	1,900	1,549	...	...	570	465
South America	888	855	...	...	193	174
E. & S. Africa	218	200	...	...	....	....
West Africa	85	87	...	...	....	....
West Indies	30	31	...	...	....	....
All Other	400	438	234	242	49	52
Total ex U. S.	9,597	11,269	620	595	2,079	2,203
World total	26,397	25,287	620	595	13,459	11,119

Competing group (based on spinning performance)	*Group 4*		*Group 5*		*Group 6*	
Typical cotton goods made from this group	Print cloths Shirtings		Dress goods Tire yarns		Finest goods Sewing thread	
Normally suited for spinning yarn counts	25s to 60s		60s to 80s		Above 80s	
Staple length of American cotton in the group	1" to 1 1/8"		1 1/8" to 1 3/8"		1 3/8" and over	
Growing Season	1931–32	1930–31	1931–32	1930–31	1931–32	1930–31
United States	3,559	2,749	856	450	15	24
Mexico	22	35	6	7	...	...
Egypt	....	....	1,012	1,231	274	430
Sudan	....	....	24	24	121	82
India	....	....	....	....	...	...
China	....	....	....	....	...	...
Russia	....	....	....	....	...	...
South America	1,330	1,084	....	....	...	...
E. & S. Africa	210	209	390	380	95	92
West Africa	13	17	200	180	5	3
West Indies	85	87	....	....	...	...
All Other	116	139	25	26	5	5
			1	5	...	...
Total ex U. S.	1,776	1,571	1,658	1,853	500	612
World total	5,335	4,320	2,514	2,303	515	636

The Sakellaridis from the Sudan was especially long and silky a few years ago but the quality has apparently deteriorated. Furthermore, plant diseases have in the recent past considerably reduced the quantity although reports for the current season indicate that much progress has been made in combating these diseases and production seems to be coming up to the earlier level. The quality of Egyptian Sakellaridis has also deteriorated, but experiments with other varieties of similar staple characteristics are making good progress. Some of the north Brazilian cotton, possibly seventy thousand bales, has the staple length of this group, but it is generally regarded as inferior owing to its irregularity.

TABLE III

THE POSITION OF THE UNITED STATES IN THE PRODUCTION OF COTTON IN EACH STAPLE GROUP
(Based on information available Feb. 15, 1932)

	1931–32			*1930–31*		
	Total Production (Bales)	*U. S.* %	*All Other* %	*Total Production* (Bales)	*U. S.* %	*All Other* %
All Kinds	26,397,000	64	36	25,287,000	55	45
Group 1 (Rough, under 7/8")	620,000	..	100	595,000	..	100
Group 2 (Smooth, under 7/8")	3,954,000	25	75	6,314,000	30	70
Group 3 (7/8" to 1")	13,459,000	84	16	11,119,000	80	20
Group 4 (1" to 1 1/8")	5,335,000	67	33	4,320,000	64	36
Group 5 (1 1/8" to 1 3/8")	2,514,000	34	66	2,303,000	19	81
Group 6 (1 3/8" and over)	515,000	3	97	636,000	4	96

Ten years ago the production of Sakellaridis and competing cottons was less than the demand and there was a general belief that the demand would increase indefinitely. Sakellaridis was required for tire yarns for all good automobile tires, and the increasing production and use of automobiles was well known. The outlook was changed by the introduction of the cord tire, which reduced the tire requirements for Sakellaridis cotton to that needed for the best truck and bus tires only, and practically eliminated the ordinary passenger automobile tire from the Sakellaridis class. Of course, the requirements for sewing thread and fine goods were not affected.

SUBSTITUTION OF COTTON

Whatever may be the case with its industrial organization and financial set-up, the cotton spinning industry has shown itself most adaptable technically to the quality of the cottons available for its spindles. Hence, any grouping such as that here suggested is subject to change with changes in spinning technique. Furthermore, present-day technique makes it possible to use cotton less satisfactory than those normally required for the type of goods produced. The less satisfactory cottons, however, are usually subject to higher manufacturing costs and will not be used unless price relationships compel the replacement of the more satisfactory cotton by one less satisfactory for the purpose.

WORLD PRODUCTION

In spite of this tendency to substitute, the six groups suggested make it possible to see more clearly than simple estimates of total production, what cottons are available for different uses. Table II is a summary of the world production estimates for the current season (1931–1932) as compared with the past season (1930–1931), on the basis of information available February 15, 1932. The information upon which the grouping has been made is reasonably satisfactory for the purpose and the totals for the various groups show the competition American cotton has to meet.

POSITION OF THE UNITED STATES

It is interesting to note the position of the United States in each group; this is shown by Table III. The United States produces more than 80 per cent of the total world growth of Group 3. This group includes

more than half the total commercial cotton of the current season, and about 44 per cent of the production of 1930–1931. About two-thirds of the cotton of Group 4 is produced in the United States. This group is somewhat less than half as large as Group 3, but includes nearly a fifth of the world production of commercial cotton.

In Group 5, the shorter of the so-called "Long-Staple Cottons," the United States production will be about a third of the total this year. Last year production in this country was so reduced by drought that only a fifth was produced here. In many cases American cotton of Group 5 is not strictly competitive with the foreign growth cottons because it has somewhat different characteristics. However, while American cotton is preferred for some purposes, foreign growths are preferred for others. Probably the most important single use for these cottons is automobile tires. Egyptian "Uppers" are usually regarded by the mills as superior for this purpose. However, foreign growths have been placed at a disadvantage in the United States owing to the tariff. It is doubtful if any

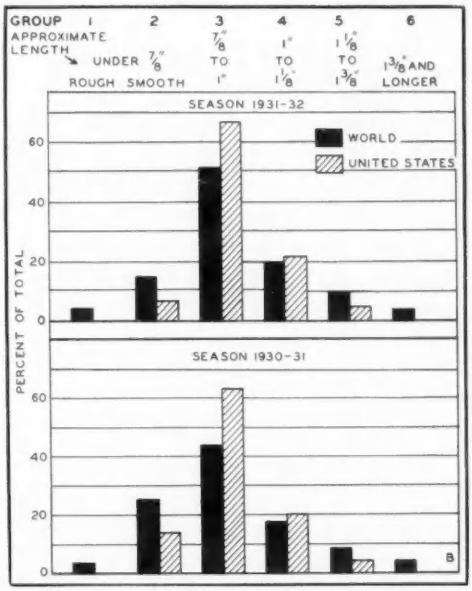

FIGURE 9.—Distribution of the various staple groups in the United States cotton production compared with the distribution in the world production.

displacement of Egyptian cotton by American cotton in the United States will have an important effect on the total world production of these cottons, although the production in the United States may be stimulated to some extent. Imports of Egyptian cotton into the United States in the few years previous to the imposition of the tariff have been around two

TABLE IV

PERCENTAGE OF COTTON IN EACH STAPLE GROUP FOR THE PRINCIPAL PRODUCING AREAS
(Based on information available Feb. 15, 1932)

Area	*Total Bales 500-lb.*	*Under 7/8"* Rough	*Under 7/8"* Smooth	7/8" to 1"	1" to 1 1/8"	1 1/8" to 1 3/8"	1 3/8" and over
Season 1931–1932							
World	26,397,000	2	15	51	20	10	2
Egypt and Sudan	1,431,000	..	..	..	..	72	28
Other Africa	303,000	..	..	..	32	66	2
South America	888,000	..	..	21	24	44	11
United States	16,800,000	..	6	68	21	5	..
India	3,360,000	3	66	31	..	..	..
China	1,100,000	25	68	7	..	..	..
Season 1930–31							
World	25,287,000	2	25	44	17	9	3
Egypt and Sudan	1,767,000	..	..	..	..	71	29
Other Africa	287,000	..	..	..	36	63	1
South America	855,000	..	..	20	24	45	11
United States	14,018,000	..	13	64	20	3	..
India	4,585,000	3	69	28	..	..	..
China	1,603,000	14	78	8	..	..	..

hundred thousand equivalent 500-lb. bales annually, the greater part of which was cotton of Group 5, although a fair quantity was Sakellaridis.

Under present conditions the United States is not an effective competitor in the production of cottons of 1⅜″ and longer staple. A small quantity of "Pima" cotton is in demand, but Egyptian Sakellaridis is frequently preferred for much of the work for which "Pimas" are suitable.

It is the belief of many authorities that cotton below ⅞″ in staple length can be produced to better advantage in India and China than in the United States. These cottons have little except their low cost to recommend them to the spinning mills. Goods made from them can be equally well made from ⅞″ cotton. In fact at the same price ⅞″ cotton is preferred, so the shorter cottons are used only when the price differential is satisfactory. As the price of the short cottons approaches that of ⅞″, mills turn to the longer cottons. The American cotton grower can in many cases produce ⅞″ or longer cotton for about the same cost as cotton below ⅞″ in staple length, and it is doubtful if it is usually to his advantage to grow this type of cotton. As a general proposition, the United States is probably not in a position to be a successful competitor in the production of cottons of Group 2.

FIGURE 10.—Thousands of bales of United States cotton at Gulfport, Mississippi, ready for loading upon a British steamer to be taken to Liverpool. (Courtesy of U. S. Bur. of Agric. Economics.)

The proportion of each group produced in more important producing regions of the world is shown by Table IV. It will be seen from this table that the United States occupies a position in the middle of the group, the bulk of its production being between ⅞″ and 1⅛″ in staple length. The longer cottons form the larger part of the cotton crops of Africa and South America while the

shorter cottons predominate in India and China. Russia has been omitted from Table IV owing to insufficient information. In general the distribution in Russia is similar to that of the United States.

American cotton producers have established their ability to produce three-quarters or more of the world's requirements for cotton spinning counts of 15s to 60s and it is here that they have the least effective competition. American cottons from $\frac{7}{8}''$ to $1\frac{1}{8}''$ in staple length are the standard raw material for these yarns. American soil and climate are, in general, most suited to these cottons and it is in these groups that American ascendency can and should be maintained.

ECONOMIC ADJUSTMENTS ON THE OLYMPIC PENINSULA

Albert L. Seeman

THE Olympic Peninsula realized the completion of its encircling highway on August 26, 1931. The highway has been hewed through vast forests, carved from towering boulders, recaptured from the waves of the ocean and made passable so that man now has a convenient artery of transportation to view the great panorama of nature (Fig. 3).

The Olympic Peninsula, the most northerly and westerly part of Continental United States (Fig. 1), is about the same size and shape as that of the state of Vermont. Though indented by many bays and inlets, and nearly surrounded by the ocean, its rugged mountains occupy all but the littoral (Fig. 2). The peninsula inherits its name from these mountains; the highest peak in this mountain system was called Mount Olympus by the first discoverers and for a time the entire group was called the Mount Olympus Range. Usage has changed the name of these mountains from "Olympus" to the Olympic Mountains. This group of mountains, belonging to the Coast Range, are not a *range*, since they have no general axis; rather they are a group of mountains around the central peak, Mount Olympus. While their general height is from four to five thousand feet, several of the peaks rise as high as seven thousand feet; the highest peak, Mount Olympus, reaches an elevation of 8,150 feet.

History

This peninsula was first discovered by a Spaniard, Bruno Heceta, in 1775. Heceta landed on the coast just north of the Hoh River, planted a cross and took possession of the country for Spain. While he was thus engaged, Indians visited his ship on a pretext of selling ore and killed seven sailors; needless to say this group of Spaniards did not stay. In August, 1790, Neah Bay was discovered by another Spaniard, Alferez Quimper. In May, 1792, Spain sent Lieut. Salvador Fidalgo to Neah Bay to organize a military post and to establish definitely Spain's claim to this new country. It was at this post that the Spaniards came into contact with the British under Captain George Vancouver; after some disagreement the Spanish government withdrew its settlement, thereby surrendering this territory to the British. In the meantime Captain Robert Gray, an American, made a trip to this region (1791–1792) and spent the winter in the inlet now called Grays Harbor. Captain Gray's trip, together with the Lewis and Clark expedition to the Columbia River, resulted in a joint occupation of the entire region by the United States and Great Britain for nearly half a century. It was not until the treaty of 1846 that the United States secured possession of the Oregon territory which at that time included the Olympic Peninsula.

In the settlement of the State of Washington the Olympic Peninsula always has been retarded. The 1930 census showed but six towns with a population of more than 500 people; these population centers (as is shown

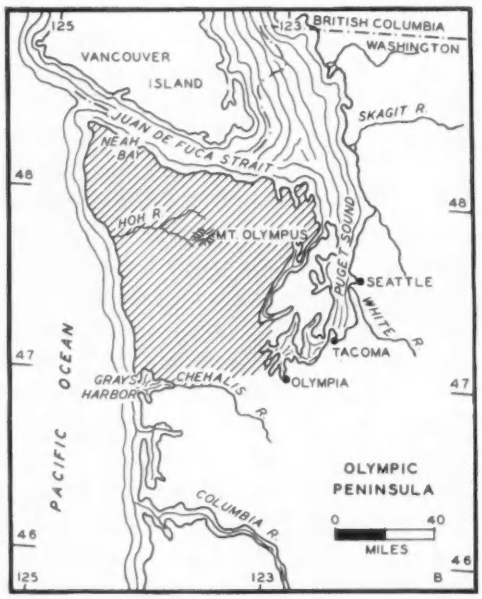

FIGURE 1.—General location and important places of the Olympic Peninsula. The shaded area indicates the Olympic Peninsula.

by Fig. 2) are shipping points which owe their size and importance to this early start and their shipping advantages.

CLIMATE

The Olympic Mountains produce a marked effect upon the climate, especially the precipitation. The maximum precipitation is felt on the windward or western side of these mountains, particularly on their upper slopes. The isohyetal map (Fig. 4) shows the regional distribution of precipitation for the peninsula.

The low western coastal plain of the peninsula receives from 40 to 80 inches of precipitation annually. The lower slopes of the Olympics and the higher elevations on the eastern sides have an average annual precipitation of from 80 to 150 inches; the higher elevations receive from 150 to 250 inches. The lightest rainfall occurs on the northeast side of the mountains; this area, lying in the "rain shadow," receives as little as 15 to 20 inches annual precipitation. Thus, in less than 40 miles there occurs a range of precipitation from more than 200 inches to less than 20 inches.

Despite the general heavy rainfall throughout the entire region, the summers are dry and most delightful. The precipitation records show that less than one inch of rain falls during June, July, August, or September for any part of the peninsula. So light is this precipitation that irrigation is necessary for agriculture during the summer months.

The temperature data show little variation throughout the entire peninsula. The average annual temperature is about 50 degrees Fahrenheit; the average for July is 60 degrees while the January average is 40 degrees. The diurnal range is slight in winter, being about 5 degrees, while the summer diurnal range may be 30 to 40 degrees.

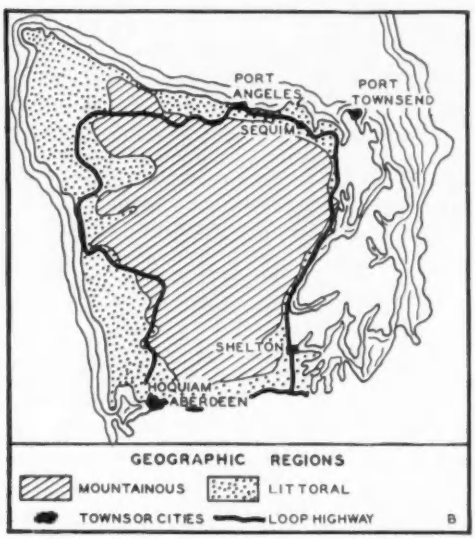

FIGURE 2.—Geographic regions of the Olympic Peninsula.

FIGURE 3.—The difficulties encountered in constructing the Loop Highway around the Olympic Peninsula. At this particular place it was necessary first to cut the trees and then to remove the stumps before the steam shovel could carve down the steep enbankment. Many of the trees were over four feet in girth.

Rarely does the temperature on the Peninsula, with the exception of the high elevations, fall below freezing even in the coldest month. Permanent glaciers and snow fields are found in these higher elevations while, below the thousand-foot elevation, it seldom snows. The growing season for the lower places is about seven months.

VEGETATION

The vegetation of the Olympic Peninsula is so varied in species and so abundant that volumes would be necessary to describe it fully. In general the entire area is forested, principally by the following species of timber: Douglas fir, western hemlock, western red cedar, Sitka spruce, amabolis fir, red alder, and Oregon maple. All of these varieties have commercial value. Douglas fir, a species of timber found only on the Pacific Coast, is prominent. Hemlock and spruce, the principal woods used in the manufacture of pulp, are particularly plentiful on the western slopes of the mountains. Flowers of all kinds abound.

FAUNA

The Olympic Peninsula is particularly well supplied with a large number and a large variety of animal life. Large herds of elk roam through the forests and mountains. Until 1931, the first year of open hunting for many years, the elk had become very tame and often proved a nuisance to the settlers by destroying the crops and the gardens. The deer in the region represent the last great bands of their species in the nation. In a short hunting season of about two

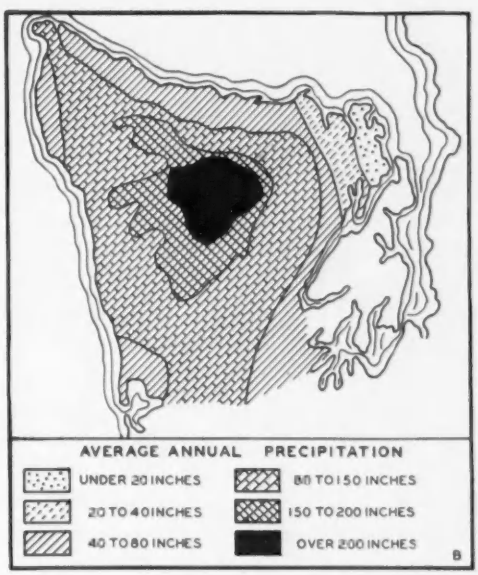

FIGURE 4.—Isohyetal map of the Olympic Peninsula.

weeks each autumn the killing of the buck but not the doe is permitted. Other animals include the black bear, cougar, wildcat, pheasant, quail, grouse, and numerous birds and small animals. The many varieties of ducks and geese visiting the region each winter afford fine sport for the hunters.

In the inland waters, the inlets, and the oceans many aquatic species are found. Although the hair seal is particularly abundant, it has no commercial value. As it lives on salmon, the state offers a bounty for killing it. The whale is an occasional visitor to the region but not frequent enough to be of commercial value. Fish are abundant in the streams and along the coast, some of the varieties being the steelhead trout, blue-black trout, cutthroat, eastern brook trout, salmon, sole or flounder, red cod, rock cod, dog fish, perch, halibut, sturgeon, bass, clams, and oysters.

FIGURE 5.—The highway as it winds through the virgin forest. The highway marker, U. S. 101, may be seen to one side of the road. The highway engineers selected those places with the least vegetation in constructing this highway to reduce the cost of construction. This gives the result.

INDIANS

There are five Indian reservations on the Peninsula containing nine tribes or approximately 2,200 Indians. Whether living on the littoral or inland they are all riparian dwellers. The lands which have been allotted to them are used for small gardens or for the grazing of their animals, no other use being made of their lands except for residence. Since these Indians are all fish-eating peoples, fishing is quite as important to them as the cultivation of their lands. They make a fair living from the sale of fish to the near-by towns or to merchants who sell the products in the more distant markets. The making of blankets, baskets, and carved wood articles is developing into an industry for which the village of Forks is becoming the marketing center.

Considerable trouble arises between the Indians and the whites over the use of lands and waters belonging to the reservations. These waters are wanted by the whites for fishing and hunting and the lands along the lakes are desired by the whites for resorts. The lands and waters have been granted to these Indians by the Federal Government and the Indians realize that their one hope for the future lies in maintaining for all time the privileges granted to them; experience has taught them that they cannot relinquish any of their granted rights, even temporarily; for the tendency seems to be for all deviations to increase, rather than decrease, in the future.

The problem of securing harmo-

nious relationships between Indians and whites will be more difficult in the next few years as the Olympic Peninsula becomes better known and more accessible.

AGRICULTURE

Agriculture and agricultural possibilities on the Olympic Peninsula are limited, owing to (a) the poor soil throughout most of the peninsula, (b) the excessive rainfall on the western side of the mountains, (c) the rugged topography, and (d) the cost of removing the stumps and brush from the land previous to cultivation. As a result of these handicaps, agriculture is practiced chiefly on the northern and eastern coasts, and in the broader river and creek valleys (Fig. 6). The risk of fire near the forests eliminates the utilization for agriculture of much land which, otherwise, might be put into crops (Fig. 7). The cost of clearing the recently logged off lands to make them suitable for farming is estimated at about $300 per acre. The cash outlay of clearing is reduced considerably because much of the work is done by the settler himself. The cost of clearing must be added to the original cost per acre (Fig. 8). As a result of all these limitations, the farms are usually very small, devoted chiefly to the growing of vegetables. Vegetables, because of their large yields and the fact that they can be used by the producer, regardless of the market, are grown extensively.

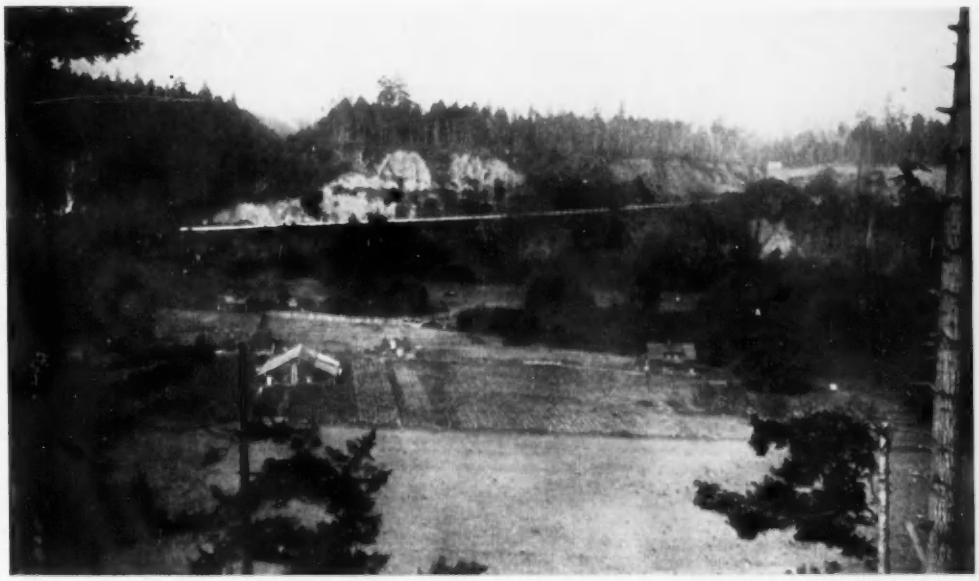

FIGURE 6.—This is one of the many valley bottom farms on the peninsula. The white concrete highway, U. S. 101, can be seen on the opposite hillside.

Along the north and northeastern part of the peninsula few trees are found. In addition, sub-irrigation solves much of the drainage problem which becomes serious along the western side. In places where drainage is necessary pasture and hay crops take a large proportion of the agricultural land. With forage as a basis, dairying becomes an important industry, directing the crops that are

produced in the immediate vicinities to such crops as will further the industry. The mild winters and summers increase the milk production from the cows. Creameries in or near the milk-producing regions aid the farmer in getting a good return from his most easily produced crops —the grasses and forage.

FIGURE 7.—Patch agriculture, so typical on the western side of the peninsula. A small patch has been cleared in the second growth timber where vegetables are raised for home consumption. The three or four cows belonging to each of these farmers are permitted to wander through the forest and along the highway in the search for food.

Poultry raising in some communities has also become an important industry. There is no immediate marketing limitation for eggs since the eggs from this region are shipped to all parts of the United States.

Environmental conditions favor truck farming; however, the lack of an adequate market at present reduces this activity to greater home consumption.

Bee-keeping is carried on extensively, it being a profitable industry because the apiaries can be put in the low-priced logged-off stump lands and no special protection need be given the hives at any time during the year, as is demanded in the interior.

MINING

At the present time there is no regular mining on the Olympic Peninsula. Manganese minerals are found at numerous places and prospecting for them is taking place in the vicinity of Lake Crescent, near the city of Port Angeles.

Oil is found at several places on the western slope of the Olympic Mountains. Some drilling has taken place at scattered points around the entire peninsula in search of oil but as yet none has been found in quantities large enough for commercial use. None of the wells has gone to any great depth.

Gold prospects were discovered many years ago on the eastern slopes of the Olympic Mountains. However, there has been no exhaustive exploration and no regular production of gold on the peninsula.

FISHING INDUSTRY

The inland streams and lakes contain a large variety of fish which, for the most part classified as game fish, may not be caught for commercial purposes. Nevertheless, at the present time, the fishing industry ranks next to that of lumbering. Grays Harbor and Seattle are the chief market centers for these products.

Salmon is by far the most important fish; this species not only yields the largest number but also gives the greatest financial returns. The catch of salmon in this vicinity has been decreasing steadily since 1914 due to the depletion caused by over-

FIGURE 8.—This picture gives some conception of the cost involved to clear the ground for a grain crop. The many stumps, the broken logs, and the dense brush must be removed before the plow can break the ground.

fishing. Halibut, from a large halibut bank just west of the peninsula, are brought to market in small catches, the limiting factor being the inability to market them profitably. Many other varieties of fish could be secured near by if the market were ample to absorb them.

At present the shell-fish industry is largely undeveloped. Shrimp dredged from Hood Canal in considerable quantities find an adequate market. The clam canning industry is centered around Aberdeen. It has suffered at least a temporary halt, due to the exhaustion of the supply. The crab industry is important from the standpoint of potentiality rather than present production. The most important industry, from the standpoint of possible commercial development, is the oyster industry, which although relatively new, is of increasing importance. The lack of bays and estuaries here, as compared with the Atlantic coast, will always be a limiting factor for this industry. The native oyster, i.e., the Olympic oyster, as well as the Japanese oyster, has been developed successfully. Several oyster farms in Hood Canal are operating with some degree of financial success.

The fishing industry for the future can be summarized only in terms of the different species of fish. Salmon fishing will continue to decline in importance because of the excessive taking of the fish. Halibut fishing, which is in its initial stage, will increase in importance, since the supply of halibut scarcely has been touched. The importance of the oyster industry in the future depends upon the market plus the success with which the Japanese oysters can be transplanted and fostered. The crab industry, while small at present, will continue to improve in the future.

LUMBERING AND FOREST PRODUCTS

Logging and lumbering, the backbone of all present-day industry on the Olympic Peninsula, are destined to remain so for many years to come. The peninsula contains one of the largest stands of timber in the United States. The Pacific Northwest, including the states of Washington, Idaho, Oregon, and western Montana, contains about one-half of the remaining timber in the nation, produces about one-third of the lumber of the nation, and represents about one-fifth of the timber-producing area of the United States. No area of equal size in this Pacific Northwest has as much timber per acre, produces as much lumber, or has as

FIGURE 9.—A view of the many lumber mills that line Grays Harbor. This group of mills include shingle as well as other lumber mills.

much possibility as does the Olympic Peninsula.

Nowhere in the world, except among the redwood forests of California, does timber approximate the size found among the gigantic trees of the Northwest, with the Olympic Peninsula no exception. The generally humid conditions produce firs towering 300 feet or more into the air and measuring eight to ten feet through, and cedars even exceeding this girth of bole.

This region has great timber possibilities for the future, especially if one considers that no timber in the nation, with the exception of the California redwood region, grows as quickly as that in the Pacific Northwest. Furthermore, no planting is necessary here unless the fires have burned the logged areas and destroyed the seedlings and small growth. The extremely rugged topography of the peninsula will prevent the farmer from following the logger. Finally, about 60 per cent of the peninsula is in State or National reservations; their policy is to keep these reservations timber-producing areas.

The national government, in connection with the national forests and the Indian reservations, follows a policy of not saving the timber, but rather of maintaining a continuous yield of timber. Under such a policy rigorous rules regarding logging and the burning of slashings are enforced. This tends to permit the seedlings and young trees to develop and grow into another crop of timber. The state government is making some effort to follow the lead of the national government by applying the policy to some extent on those lands which it acquires annually through the non-payment of taxes. On much of the cut-over land fires have destroyed the results of reforestation, and planting is necessary.

The actual stand of timber is unknown and estimates vary; yet conservative estimates place the standing timber on the peninsula at about 53 billions of board feet. This, at least, serves as an indication of the timber resources available. At present the commercial value of timbered land is from $175 to $200 per acre, the price received from actual sales. Some sales run as high as $400 per acre for selected tracts.

The Douglas fir, the leading species of lumber produced in the Olympic Peninsula, attains in some instances an enormous size, varying probably from four to eight feet in diameter and from 150 to 250 feet in height. The Douglas fir from the Pacific North-

west in general and from the Olympic Peninsula in particular, with its great diversity of uses, commands a strong hold on the domestic and the foreign markets, assuring sale for any production that may be turned out in the future. The lumber from these trees is turned out in both large and small mills located along the fringe of the peninsula. Many of the small mills are temporary structures operating either when there is an excessive demand for lumber, or when the owner and his associates are unable to secure profitable employment in the larger mills. Examples of these smaller mills may be noted particularly in the vicinity of Port Angeles.

FIGURE 10.—Pulp mill at Port Angeles. The large conical piles of ground wood may be seen under the trestle at the right. The logs used for lumber and pulp are in the mill pond at the left. The better logs are used for lumber; the rest is ground up for wood pulp.

Approximately one-half of the nation's supply of shingles comes from the State of Washington. Practically all of the necessary cedars which furnish the material for this great industry are supplied by the Olympic Peninsula. It is natural then that the center for this shingle industry should be at Grays Harbor (Fig. 9).

The red alder, the big leaf maple, and the black cottonwood trees are giving rise to a new industry for this region, viz., the making of plywoods, veneers, and furniture. They are a rapidly growing species, regrowing every 25 to 40 years, when cut, and to a diameter of four feet. They thrive particularly well in valley bottoms. This new industry is also located in the raw material center near Grays Harbor.

In addition to the timber used for lumber and shingles, timber used in the making of wood pulp for the manufacture of paper, is increasingly important. This industry is also relatively new, having been introduced into the area in the last ten years. Since the larger percentage of the land on the peninsula is or was at one time timbered land, it is quite natural that there should be a large lumber industry. But the pulp industry is a large investment type of activity, and, as such, comes relatively late into a region. This newer industry on the Olympic Peninsula has greatly increased investments, payrolls, and timber utilization on the peninsula. The wood pulp industry, now firmly entrenched in the region, should show a great expansion in the future.

Since at least 45 per cent of the pulp wood consumed in the United States is imported, and the forests of

eastern United States are nearly depleted, the wood pulp industries are looking toward this particular area. Spruce and hemlock are the primary woods used for pulp although improved methods now permit the use of other woods.

In the past four years wood pulp plants have been installed at Hoquiam, Port Angeles, and Port Townsend by eastern capitalists (Fig. 10). The pulp industry can continue to prosper even after lumbering decreases in importance, since the fast-growing hemlock and other small trees which are unsuited for lumber can be used in the making of pulp.

There is little question that in the future, as in the past, the timber resources will dominate the economic activities of the Olympic Peninsula. A large proportion of the land is unsuited for the production of any other crop except timber because of the rugged topography. Every town that has developed, so far, on the peninsula owes its existence to timber or timber products, and while it is true that the majority of one-industry towns are unstable, the stability of the Pacific coast timber industry which, practically speaking, is just in its infancy here, insures prosperity for these towns for many decades. Furthermore, an effective system of perpetuating the forests will make these one-industry towns grow in importance as timber in other sections becomes exploited.

RESORT INDUSTRY

The resort industry, which is the newest economic activity on the peninsula, promises to become of increasing importance as time goes on. Although a very few resorts have been established around the peninsula at the present time, the real development will begin now since (a) the highway completing the circumvention of the peninsula has been opened, and (b) as the Pacific Northwest becomes better known as a resort center.

FIGURE 11.—The ocean beach at this place is not more than 100 feet from the highway. The giant trees rising from the water's edge are along most of the western coast.

The former inaccessibility of the peninsula was one of the most serious drawbacks for potential resorts; accessibility was prevented by the absence of highways in many parts and the presence of narrow, ill-kept highways in others.

The large number of beautiful, clear, mountain lakes which are completely surrounded by forests, make

ideal spots for resorts. Since the opening of the new Loop Highway many resorts are being constructed. The resorts vary in type from the tourist cabins and auto camps to quasi-palatial hotels which offer golfing, boating, and dress-suit dinners. In other words, a great variety of resorts is being established. The resort places already established find business increasing and demanding more space and added accommodations.

The basis for the resort industry lies on a few environmental factors. The virginal rugged mountains, tall, giant trees, mountain streams, and deep blue lakes, make their alluring appeal to the urban dweller from relatively near large and well-established city centers. The proximity to the ocean along much of the highway is an attraction that is well-nigh irresistible (Fig. 11). The many quaint Indian villages complete the setting for an attractive resort industry.

FIGURE 12.—The stumps and slashings are burned in great piles as the quickest method of clearing the ground. Some estimate of the size of this pile may be had by noting the person indicated by the arrow. This pile was over 50 feet high.

CONCLUSION

The Olympic Peninsula is a region exemplifying an economic history and changing economic adjustments unlike those of most other parts of the United States. It has been one of the last sections of the United States to become settled and inhabited and has not experienced the orthodox series of adjustments. The hunter and the trapper are, and were, the occasional outdoors man who hunts for sport and not for a living, due chiefly to the fact that the Olympic Peninsula was first occupied at a time when there was a greater need for lumber than for hides and skins.

Lumbering in the Peninsula has been favored by a series of environmental and historical factors. Timber resources, which here can be so easily produced in large quantities, are becoming scarcer year by year in other parts of the United States. Rugged topography and thin soil, while permitting timber growth and silviculture, prohibit grazing and crop agriculture. The farmer tends to become an important social, political, and economic factor in every part of the world where the environmental elements do not prohibit; in the Olympic Peninsula the farmer can never be important. As a result, the logger will not be followed by the farmer but rather by another logger as soon as another crop of timber grows.

The infant resort industry may become stalwart and robust in a short time. It will become large partly because the other economic adjustments of the peninsula do not conform to the conventional progress of

economic adjustments, and the natural environment favors recreation and rest. Some of the important environmental factors that favor the resort industry are: (1) The Olympic Peninsula is located near large urban centers, in the mountains, and within sound of the ocean. (2) The virginal, largely unexplored country makes its romantic appeal to the most sophisticated urbanite and vacationist. (3) The game life is sufficiently abundant to tempt even the most amateurish sportsman. Finally, (4) the extremes and the continuous variety in scenery make the Olympic Peninsula a pleasant tourist place.

FIGURE 13.—Part of the fishing fleet at LaPush.

WILD PLANT INDUSTRY OF THE SOUTHERN APPALACHIANS

Ina C. Yoakley

THE major industry in many parts of the Southern Appalachian Mountains is the gathering of indigenous wild plants which nature provides in quantity throughout this region where the lumberman has not been too active in his exploitation of timber resources.

The roots, stems, branches, leaves, flowers, and fruits of the wild flowers, the weeds of the waste places, the shrubs and trees of this section, each make a contribution to the well-being or the happiness of man somewhere throughout the civilized world.

Two seasons of the year supply products for this industry—summer, when botanical drugs are gathered, and winter, when decorative greens are gathered for the floral markets. There is some overlapping of the two seasons as will be explained later.

Location and Extent

Western North Carolina, both mountain and piedmont, southwestern Virginia, eastern Kentucky, and eastern Tennessee furnish seventy-five per cent of the crude botanical drugs which the continent of North America supplies to the drug markets of the world. The productive area is not more than two hundred miles in extent in either north-south or east-west direction. The business of gathering decorative greens is confined to the southeastern part of the mapped area where physical conditions seem more favorable to their growth.

The Southern Appalachians are very rich in variety of plant life. Of the two hundred fifty botanical drugs produced in the United States, more than two hundred are found in this region. The causes for this botanical wealth are to be found in its intermediate position between the North and the South; the ancient ice-sheet invasion, crowding northern species southward; and the great diversity of climatic conditions, relief, and soils.

Origin of the Summer Drug Industry

The original occupants of these lands, the Indians, had some knowledge of the medicinal value of plants. This is evidenced by the popular names of articles to be found on the drug buyer's list today, such as Papoose root or blue cohosh (*Caulophyllum thalictroides*); squaw weed or golden groundsel (*Senecio aureus*); Indian physic or hemp dogbane (*Apocynum cannabinum*); squaw bush or American cranberry bush (*Viburnum opulus*); squaw mint or American pennyroyal (*Hedeoma pulegioides*), and Indian tobacco (*Lobelia syphilitica*). People in the isolated mountain communities still fortify themselves against the onset of colds by the gathering and drying of boneset leaves; treat cuts and bruises with salve made from Balm of Gilead buds; thin and purify the blood through a beverage made from the bark of sassafras roots.

The exact date when roots and herbs were first shipped out of these mountains is a matter of conjecture, but the date, as to the piedmont

products, is pretty well authenticated. About the year 1853, Wallace Brothers, wholesale and general merchants of Statesville, North Carolina, were solicited by New York wholesale drug houses to provide them with Jamestown (jimson) weed (*Datura stramonium*), catnip (*Nepeta cataria*), and horehound (*Marrubium vulgare*) which were then being imported. These brothers, in time, specialized in the crude drug business, and their sons, now in two separate firms, continue this business in Statesville today.

FIGURE 1.—A field of cultivated ginseng. The shade is produced artificially by a covering of lathes. This makes the initial cost high. The picket fence is a means of protecting the matured plants from thievery.

COLLECTING AND MARKETING

Only a small percentage of land in this region is arable. A few small subsistence crops such as corn, rye, potatoes, buckwheat, and sorghum are grown, these being supplemented by small vegetable gardens, but are not sufficient to meet the needs of the family. When these crops are not demanding attention, the entire family spend the day or possibly a longer period on the slopes of the mountains or along the valleys between them, often traveling for miles, in search of marketable drugs. The crude-drug merchants issue a bulletin each month, giving the name of the article desired and naming the price paid for it. At the bottom of each sheet a few specific instructions are given as to the preparation of herbs, roots, leaves, and bark for the market. The buyer has a mailing list but also hands these bulletins out from the warehouse. The number of lists distributed is determined by the location of the plant—five hundred to a thousand being the usual number. The articles named for purchase vary with the location of the plant, with the season, and with the market. The plants indigenous to the piedmont areas may differ from those in the adjacent mountain areas, the active constituents upon which the potential value of the plant parts as medicinals depend vary with the season; while an epidemic of disease makes sudden inroads upon the crude drug buyer's stock, which, in turn, causes a revision of the price list.

Few plants are purchased green. In the drying process there is such shrinkage that it usually requires from three to five pounds of the green material to make one pound of marketable material. The dried botanicals, packed in gunny sacks, are delivered to the country store, where

FIGURE 2.—The buyer and his truck on his weekly trip. This family, located some distance off the main highway, must carry its load of several thousand galax leaves to the roadside.

the market price is paid in general merchandise, or to the warehouse of the drug buyer, where payment is made in cash.

An inspector receives the incoming stock, dumps it on the floor of the warehouse, and separating it from foreign material, bales it. The bales, which differ in size, average two hundred fifty pounds in weight. These bales are then shipped by express to the drug millers or drug manufacturers located in New York, Baltimore, Chicago, and St. Louis. Some drugs go directly from the wholesaler to the large cities of Canada, England, and Germany.

COLLECTING CENTERS

When these wholesale houses were located, accessibility to the larger markets and to the area of production were prime considerations. As good roads were slow in coming to these mountains, the early buyers had to seek a location near a railway within the region (see map). The shipping centers are Marion, Virginia; Pikeville, Kentucky; Roan Mountain, Tennessee; and Asheville, Statesville, North Wilkesboro, and West Jefferson in North Carolina. There are two plants at Asheville, two at Statesville, three at North Wilkesboro, and one at each of the other places mentioned.

Only one of these plants does any milling, that is, reducing the crude medicinal to the form of a powder for use by the druggist or manufacturer of medicines. Another plant supervises the collection of all wind-blown pollens, the extract of which is used to give immunity to hay fever sufferers. Another has a crude still where the essential oils, birch, spearmint, and sassafras are extracted on a small scale.

Because of the growing scarcity of a few plants, such as Lady's Slipper (*Cypripedium* sp.), ginseng (*Panax quinquefolium*), and golden seal (*Hydrastis canadensis*), and because of the high prices paid for each when times were normal, there has been some attempt at cultivating these plants; however, there are difficulties. The initial cost of planting is great since the plants must be shaded artificially if not grown in the natural shade of the forest. Ginseng requires about seven years to reach maturity; the roots must be dried by artificial heat and the drying process is so exact that great skill is required in the handling, while there is also danger from pests, and, when it is ready to be harvested, from thieves. Since the quality of the cultivated plants is not so good as that of the wild plants, the market price is never so good. These facts are not encouraging to attempts. Hence there

are only few small farms, and these are located in the Valley of East Tennessee and in western North Carolina.

WINTER PRODUCTS

The decorative greens are few in number of species and are not so

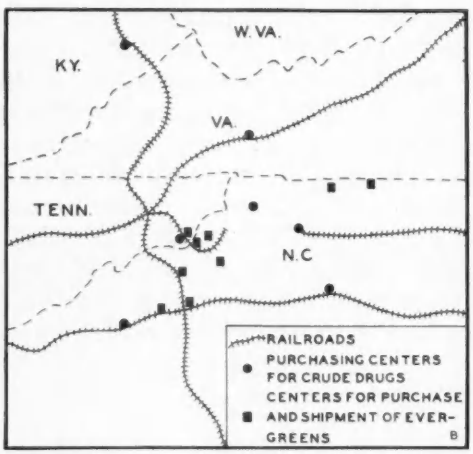

FIGURE 3.—One of the chief sections for production of native drugs, greens, and herbs.

widely distributed as are the crude drugs. The galax leaves, best known and most important of the greens shipped from these mountains, are gathered over an area of seventy-five miles in length by ten miles in width along the sides of these mountains. Other marketable greens are fancy (*Aspidium*), and dagger (*Polystichum*) ferns, leucothoe, Ground Pine (*Lycopodium*), hemlock, mountain laurel, and sheet moss.

The gathering of these greens is the major industry in many parts of Watauga, Avery, Mitchell, and Burke counties of western North Carolina, and is of importance, as previously stated, throughout the southern part of the area mapped. Many of the inhabitants run accounts at the country stores, with promise of settlement when the galax season opens. In some of the counties schools close for the winter months, so that the children may assist in the work of gathering galax leaves. The green season, as it is locally known, opens at the time when the plants have finished their growth, about the latter part of June, and lasts until the middle of November, at which time the bronze season is ushered in by the approach of cold weather. This period is the overlapping period of the two seasons.

There are two physical conditions necessary in the color transition of the leaf. These are low temperatures and sunlight. The latter does not penetrate to the undergrowth until the leaves of the deciduous trees have fallen. The gathering of the greens differs from the collection of crude drugs in that it is usually done under contract. The buyer contracts with the gatherer for a certain number of cases, which contain ten thousand leaves each, to be ready at a specified date. The collector may sublet a contract or may agree to provide only so many as he and his family can gather. Each morning, from early November to the latter part of February, weather conditions permitting, a small army of expert "galax pickers," "fern pullers," and "spray cutters," attack the forest-covered slopes and by the early afternoon they have gathered as many as can be assorted and tied by "bed time." The leaves, fronds, and sprays are put in bunches of twenty-five, which must be uniform in color and size.

These bunches are then packed carefully in gunny sack or sheet and marketed in the same manner as the crude drugs. As good roads now penetrate the mountains, the buyer frequently sends a truck along the

main traveled roads to collect the greens. The pickers may be seen along the highway in some protected spot, awaiting the coming of the trucks. The buyer then takes these to the warehouse and looks them over to see that no small or imperfect leaves have been included. He then surrounds them by sphagnum or sheet moss and packs them in boxes. If the weather is warm, he places a block of ice in the center of the box. Most of these leaves are shipped by express to the wholesale florists throughout the United States and Canada.

The purchases made in the summer months are frequently held for the winter market since *green* leaves are wanted throughout the year. Some of the warehouses are equipped with refrigeration systems. The ferns are kept at 20° F.; the other greens at a temperature of 32° to 34° F.

At one plant a very unique thing is done. The leaves are dyed and so treated that they are indefinitely preserved even though exposed to all sorts of weather conditions. At this and other points, boxes of greens are packed for the retail Christmas trade.

The name of the originator of the trade is a matter of controversy but greens have been shipped from this section for a period of thirty-five years. The centers for shipment are Low Gap, Spruce Pine, Mount Airy, Pineola, Banner Elk, Elk Park, Old Fort, and Marion, North Carolina, and Roan Mountain, Tennessee, the last named being within only a few miles of the North Carolina line.

FIGURE 4.—The marketable greens; from left to right: Top row—Shield or fancy fern (*Aspidium marginale*); laurel (*Kalmia latifolia*); wood fern (*Aspidium spinulosum*). Bottom row—Christmas fern (*Polystichum acrostichoides*); Carolina ground pine (*Lycopodium carolianum*); galax (*Galax aphylla*); and hemlock (*Tsuga carolianum*). Center—Fetterbush (*Leucothoe sp.*).

MAGNITUDE OF THE INDUSTRY

The value of the industry is estimated in thousands of dollars. During one year preceding the depression, one crude-drug merchant bought crude botanicals to the value of one half million dollars. In the same year a buyer of greens shipped forty thousand pounds of mountain laurel sprays during the months of November and December These were shipped by freight in carload lots. A very conservative estimate places a yearly return of fifty thousand dollars to western North Carolina for galax leaves alone. In normal years hundreds of carloads of crude botanicals and thousands of cases of decorative greens are shipped. This furnishes employment to hundreds of people to whom it is the chief means of livelihood and to whom plant products are "the coin of the realm." A good "galacker" can pick ten thousand leaves per

day, for which he will receive four to six dollars, depending upon the market price. His activities are limited only by distance and weather conditions. The owner of the land, whether it be government, corporation, or individual, knows the interest of the plant gatherer in fire prevention, for it takes a burned-over area from three to five years to recover itself. In only two instances did a buyer report having to secure a lease for collecting privileges.

FIGURE 5.—A "galacker" and his wife at home. This is one of the poorer homes of the mountains but the poor physical environment dooms them to poverty.

PRESENT AND FUTURE OF THE INDUSTRY

Both phases of the industry are sharing in the general economic depression. The warehouses of the crude drug dealers, aggregating two hundred thousand square feet of floor space, are packed from floor to ceiling with bales awaiting a market. Only a few wild plants are growing scarcer. The varying demands of the drug market give nature a chance to replenish her stock.

The crude drug collector must enter into competition with the poorly paid European labor, since most of these medicinals are also found on that continent. Synthetic oils, having the same composition as the natural oils, are being placed on the market at a price much below that of the latter, even though the natural oil may be superior in quality.

With the general increase in knowledge concerning disease and treatment of the same has come a larger use of the surgeon's skill, vaccines, and serums, all of which make inroads upon the crude drug trade. However, patent medicines, in the manufacture of which the larger portion of the marketed drugs are used, will likely continue to be in universal demand.

The crude drug merchants in the southern part of the area are already noting a diminishing supply of medicinals due to the establishment of the Smoky Mountains National Park, which, as other national parks, will be administered in the interest of conservation of native plants rather than in their exploitation.

FIGURE 6.—The packing-house at Low Gap, North Carolina. Nearly a hundred people are employed in the assorting and packing of the leaves which are dyed and treated in the building in the rear. This little mountain village is supported by this single industry.

The evergreen industry does not fluctuate as does the crude drug business, since eighty-five per cent of all the evergreens marketed are used for weddings and funeral occasions. The many hazards of the business are forest fires, which are a constant menace; hail storms, which

make havoc with the leaves of the evergreens; severe drouths, which make it difficult to meet the demands of the market for large leaves. The warm winters blast the hopes of higher prices paid for properly bronzed leaves, while, if the winters are too severe, the gatherers are kept indoors. Each year the galax picker must travel longer distances to secure the leaves, for, in the pulling, the bud for next year's growth is often injured.

Threats to the markets loom large in the mind of the buyer, but to the native mountaineer of this particular region, the ruthless exploitation of the resources of his beloved mountains through the activities of the lumberman and the nurseryman brings haunting fear of loss of this economic independence. Hopefulness is based upon the governmental policy of securing large areas of these mountain lands for the preservation and proper utilization of the forests, which policy will aid the industry because the government does not exclude the plant gatherers from the national forests.

BOOK REVIEWS

UNITED STATES DEPARTMENT OF COMMERCE

BUREAU OF FOREIGN AND DOMESTIC COMMERCE

Retail Credit Survey. July–December, 1931. Domestic Commerce Series No. 64. Price, 5 cents.

German Chemical Developments in 1931. Trade Information Bulletin No. 795. Price, 10 cents.

The Forest Resources and Lumber Industry of Soviet Russia. Trade Information Bulletin No. 798.

This bulletin was published to supply the demand for information in brief and accessible form concerning the forests of the U. S. S. R. (Union of Socialist Soviet Republics). It contains available data regarding the area, composition, and exploitation of the forests.

Broadcast Advertising in Asia, Africa, Australia, and Oceania. Trade Information Bulletin No. 799.

This brief country-by-country outline gives the status of commercial broadcasting in scattered countries of Asia, Africa, Australia, and Oceania midyear in 1931. It is the third of a series of bulletins answering some of the questions with respect to the feasibility of employing radio as an advertising medium for American products in foreign countries.

The French Iron and Steel Industry and Trade, with a Chapter on the Saar. Trade Information Bulletin No. 800.

In 1931 France gained second place, after the United States, in production of pig iron, and third place, after the United States and Germany, in the production of steel.

Recent Trend in Canadian Foreign Exchange. Trade Information Bulletin No. 792.

Agricultural Implement Market of France and the French Colonies. Trade Information Bulletin No. 794.

American Lumber in New Zealand. Trade Information Bulletin No. 796.

The Motion-Picture Industry in Continental Europe in 1931. Trade Information Bulletin No. 797.

Philippine Cotton Piece-Goods Market. Trade Information Bulletin No. 793.

Handbook of Foreign Tariffs and Import Regulations on Agricultural Products. Part V. Grains and Grain Products in Europe and Other Major Markets. Trade Promotion Series No. 131. Price, 50 cents.

International Marketing of Surplus Wheat. Trade Promotion Series No. 130. Price, 5 cents.

Since the close of the World War the production of wheat has continuously advanced. The world's visible supply of wheat in every month of 1925 and subsequent years shows a steady, and in the 1929–1930 crop year an extraordinary, increase, reaching on January 1, 1930, the peak figure of just under 600,000,000 bushels, which compares with a visible supply on January 1, 1926, of approximately 325,000,000 bushels. The average volume of the exports of wheat and wheat flour for the period 1922 to 1930 was in the neighborhood of 810,000,000 bushels.

Hardware Distribution in the Gulf Southwest. Part IV of the Commercial Survey of the Gulf Southwest. Domestic Commerce Series No. 52. Price, 70 cents.

This report includes the states of Arkansas, Louisiana, Mississippi, Missouri, Oklahoma, 21 counties in western Tennessee, and all of Texas, with the exception of 3 counties west of the Pecos River. The report covers the trading areas of wholesale distribution of hardware, with the factors limiting these areas, the lines handled, and practices in selling, general methods in retail distribution, and the expense of financing sales of hardware. This report is a part of a larger regional program involving a series of distribution studies, to be supplemented with studies of transportation and banking within the territory, and has already been preceded by a bulletin on dry goods distribution and two reports covering the production and distribution of cotton and of petroleum in the same area.

General Consumer Market Statistics: Supplement No. 1 to Market Data Handbook of United States. Domestic Commerce Series No. 56. Price, 60 cents.

This supplement to the Market Data Handbook gives additional statistics from the consumer standpoint, showing the buying capacity of the population in different states, the number of stores of various kinds doing business, and the sales made by such stores. An especially valuable reference for geographers.

Causes of Failure Among Drug Stores. Domestic Commerce Series No. 59. Price, 5 cents.

Drug Store Arrangement. Domestic Commerce Series No. 57. Price, 10 cents.

Prescription Department Sales Analysis in Selected Drug Stores. Domestic Commerce Series No. 61. Price, 5 cents.

Merchandising Characteristics of Grocery Store Commodities: Dry Groceries. Distribution Cost Study No. 13. Louisville Grocery Survey, Part III-C. Price, 30 cents.

Merchandising Characteristics of Grocery Store Commodities: Perishables. Distribution Cost Study No. 12. Louisville Grocery Survey, Part III-B. Price, 20 cents.

Wholesale Grocery Operations. Distribution Cost Study No. 14. Louisville Grocery Survey, Part IV. Price, 20 cents.

A Basis for Establishing Industrial Sales Territories. Domestic Commerce Series No. 60. Price, 10 cents.

This study will mean more up-to-date data upon which the market analyst can adjust his plan of allocating sales effort. It will also be of material aid to the firms that have not seen fit to establish a marketing research department. It will provide an inexpensive method of quickly establishing a fairly accurate marketing program for small firms lacking the facilities for creating or maintaining extensive market work.

Knitted-Outerwear Machinery in New York City. Domestic Commerce Series No. 58. Price, 5 cents.

Cost Control by Wholesale Grocers. Domestic Commerce Series No. 63. Price, 10 cents.

This study was made in order to aid the wholesale grocers in reducing their operating costs and improve their business methods in general.

Shipping and Shipbuilding Subsidies. Trade Promotion Series No. 129. Price, $1.10.

This study is an analysis of subsidy programs of the principal maritime nations of the world as established for periods of 10 to 25 years by laws enacted between 1923 and 1930; a detailed account of subsidies from the beginning of steam navigation and of government ownership and operation of steam shipping during a 30-year experimental period from about 1830 to 1860; a statement of economic and political forces which influenced national protection of the shipping and shipbuilding industries of maritime countries; and, finally, a review of coast-trading restrictions as of 1930, and a statement of maritime-credit provisions recently adopted.

Foreign Bunkering Stations and Charges Against Vessels. Foreign Port Series No. 3 (Revised 1932).

This directory consists of sections describing, by countries, coal and oil bunkering facilities abroad. It contains such details as code addresses and codes used, types and loading speeds of mechanical loading facilities, kinds of fuel available, sources of supply, method of delivery, extent of advance notice required by fueling depots; and other pertinent data. A section showing the charges which a ship would incur in calling at ports for bunkers only has been added to this issue as a further assistance in determining comparative bunkering costs. This publication was prepared in the Bureau of Foreign and Domestic Commerce in coöperation with the Bureau of Operations, U. S. Shipping Board.

Monthly Summary of Foreign Commerce of United States, Parts I and II. Single copies, Part I, 10 cents; Part II, 5 cents. Annual subscriptions, $1.25.

Part I contains statistics of exports of domestic merchandise, and imports by articles. Part II contains summaries of export and import trade; monthly average import and export prices; and statistics of trade with Alaska, Hawaii, and Puerto Rico.

Index to Commerce Reports, Nos. 40–52, Vol. 4, Thirty-Fourth Year, Oct.–Dec. 1931.

This index is divided into three parts, listing all articles published in Commerce Reports under subject, country, and author. Single copies, 5 cents; annual subscription, 20 cents.

AERONAUTICS BRANCH

Airway Map of United States, March 1, 1932. Aeronautics Bulletin No. 8. Free.

This map shows the air routes and airports throughout the country.

BUREAU OF STANDARDS

Standards Yearbook, 1932. Miscellaneous Publication No. 133. Price, $1.00.

This yearbook contains outlines of the standardization activities and accomplishments of not only the Bureau of Standards and other agencies of the Federal Government and the States, counties, and municipalities, but also those of technical societies and trade associations.

Visitors' Manual of Bureau of Standards, Brief Account of its History, Functions, and Laboratory Facilities. Miscellaneous Publication No. 93.

It gives a brief account of the organization and functions of the bureau and discusses the activities which are of special interest to visitors.

BUREAU OF MINES

Zinc in 1930. Price, 5 cents.

Production, consumption, and trade of the United States; also a review of the zinc industry in leading zinc-producing countries of the world.

Construction of Master Mechanical Oscillator for Testing Seismic Recorders and Other Allied Apparatus. Technical Paper No. 518. Price, 5 cents.

Natural Gas in 1930. Price, 5 cents.

Natural Gasoline in 1930. Price, 5 cents.

Cement in 1930. Price, 5 cents.

BUREAU OF THE CENSUS

Agriculture. Fifteenth Census of the United States, 1930. Published for individual states. Price, 5 and 10 cents.

Construction Industry. Fifteenth Census of the United States, 1930.

Published for individual states.

Drainage of Agricultural Lands. Fifteenth Census of the United States, 1930.

Published for individual states.

Distribution. Wholesale Distribution, 1929. Fifteenth Census of the United States, 1930.

Published for individual states.

Irrigation. Fifteenth Census of the United States, 1930.

Published for individual states.

Building Operations. Fifteenth Census of the United States, 1930.

Published for individual states.

Occupations. Fifteenth Census of the United States, 1930.

Published for individual states.

Population. Metropolitan Districts. 253 pages. Price, 85 cents.

Reports by states, showing the composition and characteristics of the population for counties, cities, and townships, or other minor civil divisions:

Volume III, Part 1, Alabama-Missouri. Price, $3.25.

Volume III, Part 2, Montana-Wyoming. Price, $3.25.

COAST AND GEODETIC SURVEY

United States Coast Pilot: Alaska, Part I, Dixon Entrance to Yakutat Bay, 1932. Serial No. 545. Price, 75 cents.

Current Tables, Pacific Coast of North America and Philippine Islands, 1933. Serial No. 542. Price, 10 cents.

Magnetic Observations. Results of Magnetic Observations made in 1930. Serial No. 544.

Magnetic Declination in United States, 1930. Serial No. 540. Price, 10 cents.

LIGHTHOUSE SERVICE

List of Lights, 1932, Great Lakes, United States, and Canada. Price, 30 cents.

Index to lights, buoys, and marks.

MILDRED R. BASHORE

TAYLOR, ALONZO E. *Corn and Hog Surplus of the Corn Belt.* xx and 658 pages; map, charts, and tables. Stanford University Press, Stanford University, Berkeley, California.

Corn and Hog Surplus of the Corn Belt is a timely discussion of a problem of world-wide interest and importance,—the long-continued and widespread agricultural depression. It treats one of the most important aspects of the agricultural problem in the United States, and does it with due consideration for the national and international situation. More studies of this kind, and a wider reading of them, would add materially to our accurate knowledge of the agricultural problem, and increase our chances of arriving at an intelligent and successful solution.

The Preface is an excellent opening statement, in brief form, of the present position of agriculture in the United States. It also contains a short, well-selected bibliography on the subject. Nowhere else in the book is any bibliography given, although frequent reference is made to various sources of information during the course of the discussion.

The Introduction, Chapter I, is rather long; but, for the general reader, is, perhaps, the most interesting and valuable part of the book. In it Doctor Taylor discusses, in summary form, the development of agriculture in the United States, the influence of American land policies, and present-day trends in the price level, the international trade account, extensive agriculture, the mechanization of agriculture, competition between animal and vegetable fats and oils, the scale of living, per capita food requirements, and the rate of growth of population. The application of these trends to the Corn Belt is shown, and some of the social and political considerations involved are brought out. It provides an excellent background for the more detailed discussion of the narrower phase of the general agricultural problem—the corn and hog surplus.

Doctor Taylor divides his discussion of the problem into two parts. The subject of Part I is the "Nature, Extent, and Consequences of a Surplus of Corn and Hogs."

Chapter II is a study of the production and disposition of the corn crop, while Chapter III is a similar study of hog production. The tendencies which are favorable, or unfavorable, to the continuance of the present surplus are enumerated, and the author reaches the conclusion that the continuance of the surplus is practically certain. In the case of corn he does see a possibility of getting rid of the surplus through a reduction in acreage, a rather unlikely happening.

The next three chapters deal with the Exports of Corn and Hogs, Domestic and International Factors in the Price of Hogs, and the Post-War Position of Corn Growers and Hog Raisers. Each chapter presents a thorough and incisive

analysis of the subject which it treats, almost exclusively from the economic point of view.

In Part II the subject of discussion is the "Amelioration of the Consequences of a Surplus of Corn and Hogs." Chapter VII is a summary of the main facts and principles of the problem from the standpoint of farm relief. The next five chapters are devoted to a discussion of various methods of agricultural aid. The methods presented are the Equalization Fee, the Export Debenture, the Farm Allotment Plan, Price Stabilization, and Internal Methods of Farm Relief. The latter method comprises "technical improvements, a better utilization of the area by a smaller number of farmers, and the adjustment of supply to demand." In view of the current debates in Congress regarding farm relief, particularly the recent introduction of the Export Debenture Plan into the tariff discussion, this part of the book is especially valuable and timely.

The book is amply illustrated with one map, 20 charts, and 59 tables. The material used has been carefully selected to show conditions and trends, and to amplify and clarify the textual matter.

Another admirable feature of the book is the brief summary at the end of each chapter. These summaries greatly facilitate the scanning of the essential points by those readers whose time is limited.

The book presents a thorough and exhaustive analysis of the situation as regards the corn and hog industry. It is primarily an economic treatment of the problem, although political, social, and geographic influences are brought into the discussion to some extent. The style is clear and concise. Altogether, it is an incisive and scholarly analysis of a complicated and perplexing problem.

A. RUSSELL OLIVER

BURGY, J. HERBERT. *The New England Cotton Textile Industry.* 223 pp.; maps and illustrations; index. Waverly Press, Inc., Baltimore, 1932.

The New England Cotton Textile Industry, as the author indicates in the subtitle, is a study in Industrial Geography, relating specifically to the physical and economic factors which have entered into the rise, and the relative decline, of the New England development of the industry. The historical localization of the industry in certain regions in New England, the geography of the raw materials consumed in the mills, the part played by various types of power in the evolution of the industry, the effect of geographic influences in the present status of the industry, and economic aspects and adjustments which characterize the industry, are all discussed and interpreted.

The author's treatment is clear and logical. Not always do his arguments seem fully convincing, but on the other hand they reveal no partisan prejudice or personal bias. Facts, as the author sees them, are frankly and conscientiously set down, and conclusions drawn from them are given for what they are worth. The chief value of the book lies in its richness of reference data and description, compacted within small compass without sacrificing adequacy. The author is to be congratulated and commended for his rigorous and careful exclusion of irrelevant and insignificant material.

The book is well and neatly bound. The paper and the type are excellent. The maps and charts are superior. The book is invaluable to the student of New England, or of the textile industry.

W. ELMER EKBLAW

TALMAN, CHARLES FITZHUGH. *The Realm of the Air.* 318 pp.; 29 illustrations. Bobbs-Merrill Company, Indianapolis, 1931.

This splendid book is truly "different," to use the "author's apology," judging it from other works on climatology and meteorology. Mr. Talman is master of an easy and fluent style and brings before the reader the prosaic as well as spectacular weather "happenings" in such an interesting manner that one finds difficulty in putting the book down before it has been read from beginning to end. The less spectacular phenomena are presented in such manner that they rank in interest with the most freakish and outstanding. Even the chapter headings smack of the delightful reading matter that follows them. These, such as "Icy Wrack and Ruin," "When the Waters Break Loose," and "Ground-hog, Pimpernell and Company," presage absorbing exposition which never disappoints the reader. Remarkable photographs add to the interest of this book.

Delightful, interesting, and entertaining, however, do not entirely do justice to this book for, above all, it is accurate. It is not a text book; it was not meant to be a text book. But it will furnish teachers and instructors of geography and climatology with a keener conception of climate and weather events. And those who are but mildly interested in the everyday weather will find that this book creates a desire to continue the study of this absorbing subject.

PHIL E. CHURCH

THOMPSON, JAY EARLE. *Our Pacific Possessions.* 264 pages; illustrations. Charles Scribner's Sons, New York, 1931. 90 cents.

"*Our Pacific Possessions*, a companion geographical reader to *Our Atlantic Possessions*, takes both the teacher and pupil on interesting journeys through Alaska, Hawaii, Samoa, Philippines, and Guam. These adventures, authentic and fascinating, include a social, civic, industrial, and historical view, vital in studying geography. Teachers may use this volume to supplement the regular lessons in geography or to teach oral and silent reading." Thus the author explains in the Foreword the scope and purpose of his book,

undoubtedly a volume in which the school child will find much to hold his attention.

One might wish that the space given to the treatment of the various Pacific possessions might be a little more evenly distributed, even with due regard for the proportionate importance of each. Alaska receives by far the most attention, about one hundred pages; the Philippines, seventy; Hawaii, forty; Samoa, twenty; Guam, ten. Howland and Baker Islands are passed by in three sentences on the way to Samoa, while Midway and Wake appear only in a table in the Appendix. Perhaps we should not waste energy being curious about these unimportant places, but they are part of "our Pacific possessions" and we'd like to know something about them.

Geographical journeys are not the easiest things in the world to write up in such a way as to include all the facts of geographical importance that should be mentioned about the region visited, but Mr. Thompson has done very well. Easy reading, pleasant and pertinent illustrations, combined with good type into a book of handy size, do not attempt to camouflage the learning of facts entirely, although they seem to be presented in their least painful form. Eight questions at the end of each chapter review the reading and stimulate further investigation,—and indicate that the book is intended for school use rather than as a story book.

PRISCILLA H. WEBSTER

BRETZ, J. HARLEN. *The Grand Coulee*. 89 pages; map, illustrations. American Geographical Society, Special Publication No. 15, New York. 1932. $4.00.

As a result of intensive field studies carried on by Professor Bretz, the fascinating story of the channeled scablands of Washington has been brought to the attention of physiographers several times during the past ten years. Numerous articles have appeared describing this unique topography of the Columbia Plateau. The present volume does not attempt to treat the entire subject with which Professor Bretz's researches have been concerned, but to present a careful analysis of one of the major features of the region, namely, the Grand Coulee.

The book is divided into five chapters. Chapter I is entitled "General Features of Grand Coulee" and is devoted almost entirely to description of the region. The influences of geologic structures, such as the High-Hill anticline, Coulee monocline, and Hartline Basin upon the development of a great system of cataracts and channeled scablands, is clearly explained. In order that the reader may be properly prepared for the more detailed discussion in later chapters, Professor Bretz summarizes at the end of Chapter I the features of Grand Coulee which strongly suggest "some extraordinary conditions of origin." These features are as follows:

"1. The upper coulee is a twenty-five-mile gash, vertically walled, 800 to 900 feet deep, across horizontal flows of the highest part of the plateau.
2. The lower coulee is a seventeen-mile canyon, nearly thirteen miles of it eroded in and along the preglacial structural hillside of the coulee monocline.
3. The two canyoned portions are separated by a five-mile uncanyoned portion on the floor of Hartline structural basin.
4. A group of immense cataracts is entrenched in the Hartline Basin. Had they receded five miles farther, the coulee would have been one continuous canyon.
5. The mouth of the lower coulee in the Quincy structural-topographic basin is blocked by huge gravel deposits.
6. Both canyoned portions have essentially no gradient.
7. The floors of both canyoned portions are closed basins.
8. The floor near the head of the upper coulee is interrupted by numerous high hills of rock.
9. Stream-channeled basalt surfaces occur on top of the walls of the upper coulee for four-fifths of the total wall length. Their maximum width is four miles.
10. The summit of the eastern wall of the lower coulee, 400 to 500 feet high, is all channeled scabland. The summit of the western wall, 700 to 1,000 feet high, has no scabland.
11. Minor tributary valleys produced by local run-off enter the coulee only where there is no summit scabland. They hang far up on the cliffs, except in the structural valley between the two canyoned portions.
12. Tributaries from scabland summits along the upper coulee have striking amphitheater-like shapes. Many have a hanging relationship, others enter the coulee at grade.
13. Lower Grand Coulee has essentially no tributaries from its margining high scabland but possesses two notable canyoned distributaries."

Chapter II includes a description of the "Distributary System of Grand Coulee." The country south of Hartline Basin was overrun by water escaping from Grand Coulee. These torrential waters produced numerous channels which later became areas of scabland deposition. Among the important areas to receive these deposits is the Hartline Basin. Many square miles are covered with gravel deposits. All exposures exhibit foreset beds which frequently dip against the regional slope. After considering several hypotheses, Professor Bretz concludes that the gravels are of stream bottom origin. In many places where the overflow water escaped, channels were cut in which gravel bars were deposited. These areas of channeled scabland

have been characterized by Professor Bretz as "river-bottom topography, magnified to the proportions of river-valley topography."

The story of glacial ice in the Grand Coulee region is reported in Chapter III. During the Pleistocene period, probably in Wisconsin time, a lobe of the Cordilleran ice sheet blocked the Columbia River some eighty miles below Spokane, thereby causing the river to overflow its banks and push south and southwestward across the Columbia Plateau. The many small streams issuing from the edge of the melting ice joined the Columbia River with the result that an enormous amount of water swept across the plateau. Professor Bretz believes that these torrential waters produced the cataracts and other features of the scabland topography. It is very likely that the ice sheet advanced several times during the Pleistocene period, but if so, the latest was most extensive. Two advances have been definitely recognized.

Chapter IV is entitled "The History of Grand Coulee." A review of the work of previous investigators occupies the first few pages. This is followed by a brief statement about the preglacial topography and early drainage lines. The reconstruction of the landscape is based upon the following facts and inferences:

"1. Except in channeled and glaciated tracts, the Columbia Plateau in Washington carries an essentially continuous, smoothly contoured loessial mantle. Ledges of rock are rare.

2. The topographic slopes in the region conform to the structural slopes. Streams are largely consequent.

3. The erosional topography of loess-covered portions is older than that of the channeled portions. The scabland (and its gravel) has relatively little dust, little gullying, little weathering, is uniformly lower than the adjacent loess-covered areas, and is much younger in terms of its striking cliffed forms and its unfilled basins.

4. The channeled scabland is a product of glacial stream erosion. The character of the drainage derangements, the indicated directions from which the water came, the deposits, and the erratic boulders widely distributed along these channelways establish this conclusion.

5. The depth of glacial stream erosion can be approximated from depths of the scabland channels, canyons, and basins; from the heights of the bare rock buttes, walls, and dry cataracts; and from the relations of hanging tributaries of the earlier normal drainage to the channels and canyons.

6. The widths and depths of the glacial streams can be approximated by the width and relief of uncanyoned scabland tracts; by the widths of abandoned cataracts; and by the depths of rock basins and the heights of river bars."

The remaining portion of Chapter IV deals with the development of Upper and Lower Grand Coulee, and the stages in recession of the various cataracts. Comparisons made between Niagara Falls and the dry falls of the scablands were impressive and helpful.

In the last chapter, Professor Bretz calls attention to some of the major geographic factors influencing development in the Grand Coulee region. Briefly he points out the possibilities of irrigation agriculture, and the ways in which scabland features might make irrigation feasible.

A review of Professor Bretz's new book is not complete until mention is made of the excellent aeroplane photographs and line drawings which illuminate the volume. The unique scabland features are effectively illustrated by means of eight stereoscopic views located in a small pocket at the end of the publication. It is safe to say that "The Grand Coulee" represents one of the finest contributions to the study of glacial phenomena thus far received in 1932.

WALLACE W. ATWOOD, JR.

JONES, LL. RODWELL. *The Geography of London River*. 184 pp. Methuen & Co., London, 1931. 11 x 9 inches. 21s.

London River is the name given by sailors to the Thames estuary. *The Geography of London River* is a substantial treatise on the evolution of one of the most interesting of the world's great ports and harbors. Its long history multiplies the interesting correlations that are possible, for London was a port before it became the capital of England. The author, Professor of Economic Geography in the University of London, is well known in America as the author (with P. W. Bryan) of "North America: an Historical, Economic and Regional Geography."

Most geographers would agree that Professor Jones begins his treatment of the estuary at the logical starting point, the physical setting of the basin. Geomorphology and geology are considered at some length; in fact, one may well wonder if some of the rather detailed facts are of much value to others than specialists.

Several cities showing arrested development are mentioned, with reasons for their decline. Local environmental factors that made the site of London favorable for bridging are among those important early in the history of the region, although their effects are but little felt in modern times.

The beginning of the nineteenth century is a particularly well-selected time at which to begin the consideration of the modern London River. Growth and change through the middle of the century are well shown, as is the commerce of the modern port. River traffic and the docks of the port of London have been, it would seem, fully treated.

The game "London Bridge is falling down" has its basis in fact. The problem of a satisfactory bridge across the river long was a difficult one, and so many different ideas were attempted that it is hard to believe that the old prints are all of the same bridge. Satisfactory sewer drainage of the city, discussed in the same chapter, was almost as troublesome.

The work of man upon the estuary and port by dredging, building embankments and wharves is well shown. Maneuvering, political and otherwise, in the improving of the river is mentioned. Nevertheless, some may well wish that more space had been given to showing the great effects of man upon the London River and his use of it—effects resulting from expanding population and a changing civilization.

The size and shape of the book are rather unusual to the American who has passed the days of grade school geographies. They are, however, quite serviceable for the forty-five maps and diagrams and four plates included. The printing is good and the style usually clear.

In several ways the book is almost to be considered as a model. The tidal Thames is a magnificent stream. There can be few such harbors in the world. Professor Jones has brought together an immense amount of documentary material concerning it, and has produced a treatise one may delve into with profit.

JOHN K. ROSE

KOEPPE, CLARENCE E. *The Canadian Climate.* 280 pp.; maps, charts, tables, illustrations; index; bibliography. McKnight and McKnight, Bloomington, Illinois, 1931.

Doctor Koeppe has rendered an inestimably valuable service to the cause of North American Geography by his work on *The Canadian Climate,* just recently issued. Nothing so authentic, convenient, and satisfactory has heretofore been available. It covers the field as adequately as the present store of data, statistics, and information permit, and constitutes, therefore, the only trustworthy basis upon which the relationship of Canadian life to the physical terrain may be expressed, the only comprehensive climatic source upon which to draw for explanation and interpretation of Canada's development and progress. Accordingly, full meed of praise and full measure of gratitude accrue to Doctor Koeppe for having undertaken so laborious a task and completing it so satisfactorily.

The book includes chapters on: I. The Non-Atmospheric Factors Controlling the Climate of Canada and Newfoundland; II. Pressure, Winds and Storms; III. Sunshine and Temperature; IV. Moisture Considerations; V. British Columbia and Yukon Territory; VI. The Continental Interior; VII. Eastern Canada and Newfoundland; and VIII. The Arctic Prairies and Archipelago.

The first four chapters which comprise highly illuminating discussions of the fundamental elements of the Canadian climate are particularly valuable. Of much significance and value, as well as of major interest, are the eight types into which Doctor Koeppe divides the weather of Canada, basing them upon pressure conditions as well as upon temperature, moisture, and wind characteristics.

The last four chapters are regional discussions and interpretations of first geographic rank, a convenient regional division founded upon common sense consideration of location, relief, vegetation and land use, as well as upon climatic elements, which permits of application to all geographic and research study. Each of the major regions is subdivided into several minor subregions, reflecting dominantly variations in climate. For the material necessary to adequate regional treatment, Doctor Koeppe has carefully investigated all the many publications relevant to the subject. This in itself should bring to him the gratitude of all investigators and students of Canadian conditions, for the publications are many, and the amount of chaff that he has had to winnow to yield the amount of grain that he has harvested, is incomprehensible to the ordinary research investigator who has no acquaintance with Arctic "literature"!

Ten pages of bibliography, forty of climatic statistics, and an index complete the book. It is one more valuable addition to the shelf of the geographer, the climatologist, the layman interested in Canada. It is well bound, and attractively. The type is clear and legible. The maps, charts, and pictures are pertinent and illustrative. It is a book well worth possessing.

W. ELMER EKBLAW

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ECONOMIC GEOGRAPHY

Published Quarterly by

CLARK UNIVERSITY, at 10 Ferry Street, Concord, N. H.

Editorial Office, Clark University, Worcester, Massachusetts

PRICE, $1.50 THE CURRENT NUMBER

FIVE DOLLARS A YEAR
(except to charter subscribers)

Entered as second class matter at the Post Office at Concord, N. H., under the Act of March 3, 1879

THE DANUBIAN BASIN

THE Danubian Basin forms one of the world's definite areas where economic integration of human interests and activities are impellingly suggested by the environment and the resources. The unifying forces of the great river which traverses the basin should be permitted dominance over the dissipating strength of racial and religious antagonisms which through long ages of history have disrupted the lives of the peoples resident within the basin. With growing enlightenment and disappearing intolerance these peoples must realize that their highest destiny lies in coöperation and coördination of effort and purpose.

In the Danubian Plan, the nations built of the long-warring peoples of the Basin recognize the beginning of a common purpose and plan for friendly unity of industrial and commercial enterprise whereby they may all share in the inherent advantages that their great river affords them. They realize as never before that the ultimate peace and prosperity of their domains depends upon community of interests and activities rather than in provincial isolation and arrogance. In this growing recognition of their common problems, their realization that the solution of these problems does not lie within the power and prestige of any one of them, but with them all, lies the greatest hope for the future of the Danubian States.

Fairly self-sufficient as a well-defined unit, with complementary reserves of power, food, mineral and soil resources, and raw materials, the Danubian States may justifiably anticipate a prosperous future if they can but unite their peoples into the integral organization their river and basin advantages indicate as best for them.

Long centuries of deep-seated antagonisms must be forgotten; old grudges handed down through the long course of history must be overcome; old injustices, old offences, old rivalries must be ignored. Eye to eye they must see; shoulder to shoulder the Danubian peoples must work for one plan, one goal.